THE

JOURNAL

OF THE

CINCINNATI

SOCIETY OF NATURAL HISTORY.

VOL. VII.

1884–85.

Publishing Committee.

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GEO. W. HARPER,	WALTER A. DUN,
DAVIS L. JAMES.	JOSEPH F. JAMES.

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Your thoughtfulness will be appreciated

CONTENTS—VOL. VII.

Vol. VII. No. 1.

THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

PUBLISHING COMMITTEE:

GEO. W. HARPER, R. M. BYRNES,
JOHN MICKLEBOROUGH, DAVIS L. JAMES,
L. M. HOSEA.

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CONTENTS.

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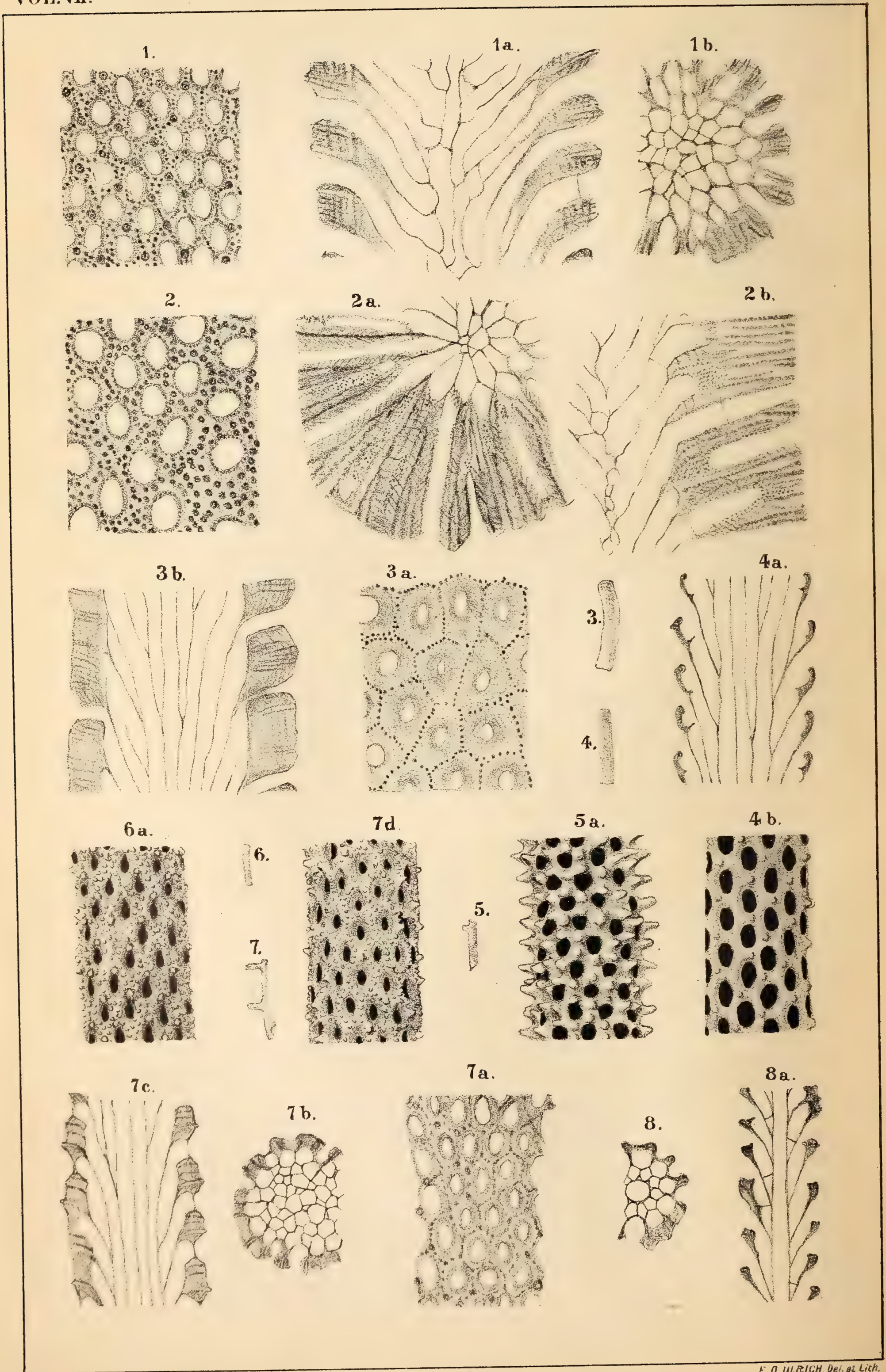

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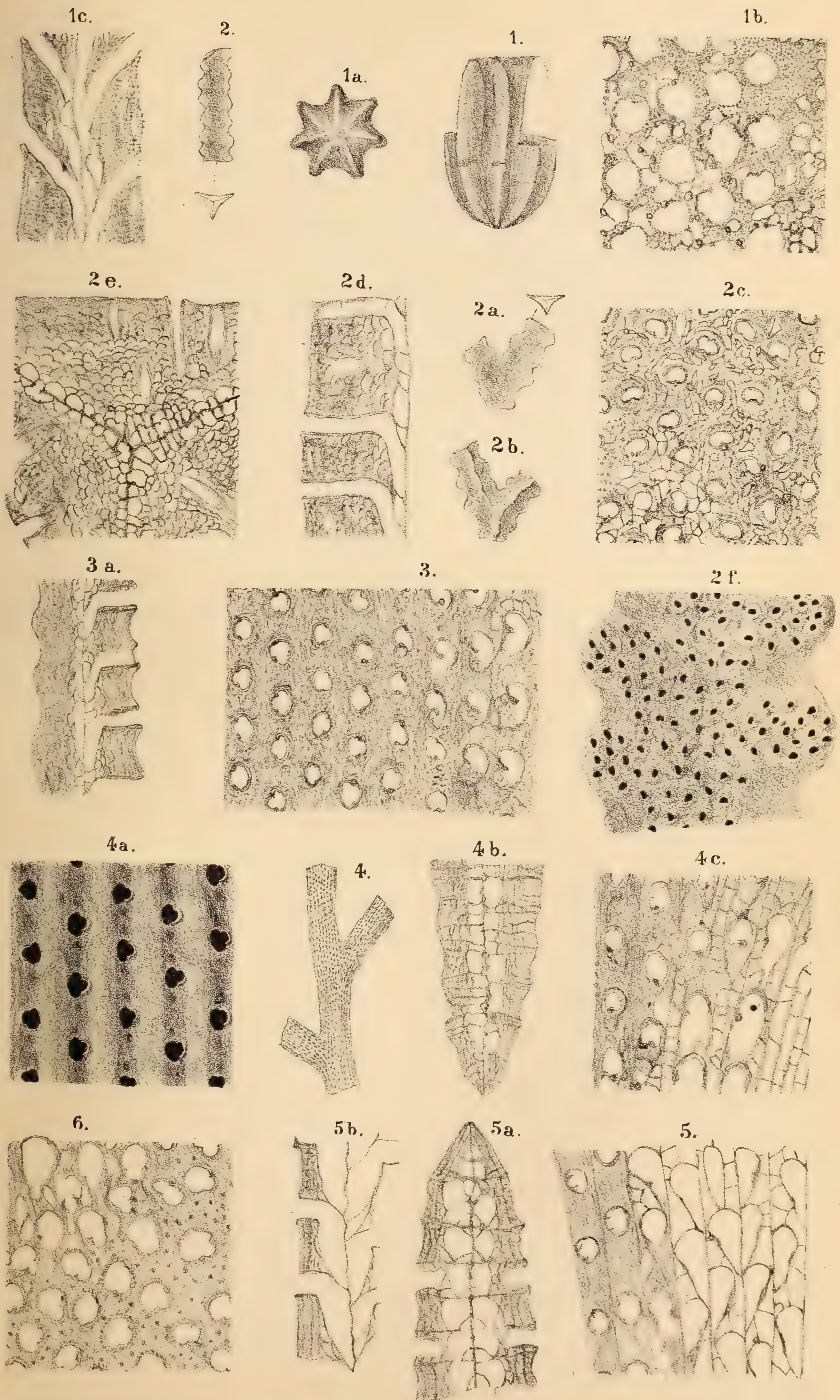
PLATE I.

All the figures, unless otherwise designated, are enlarged to 18 diameters.

PLATE II.

All figures, unless otherwise designated, are magnified 18 diameters.



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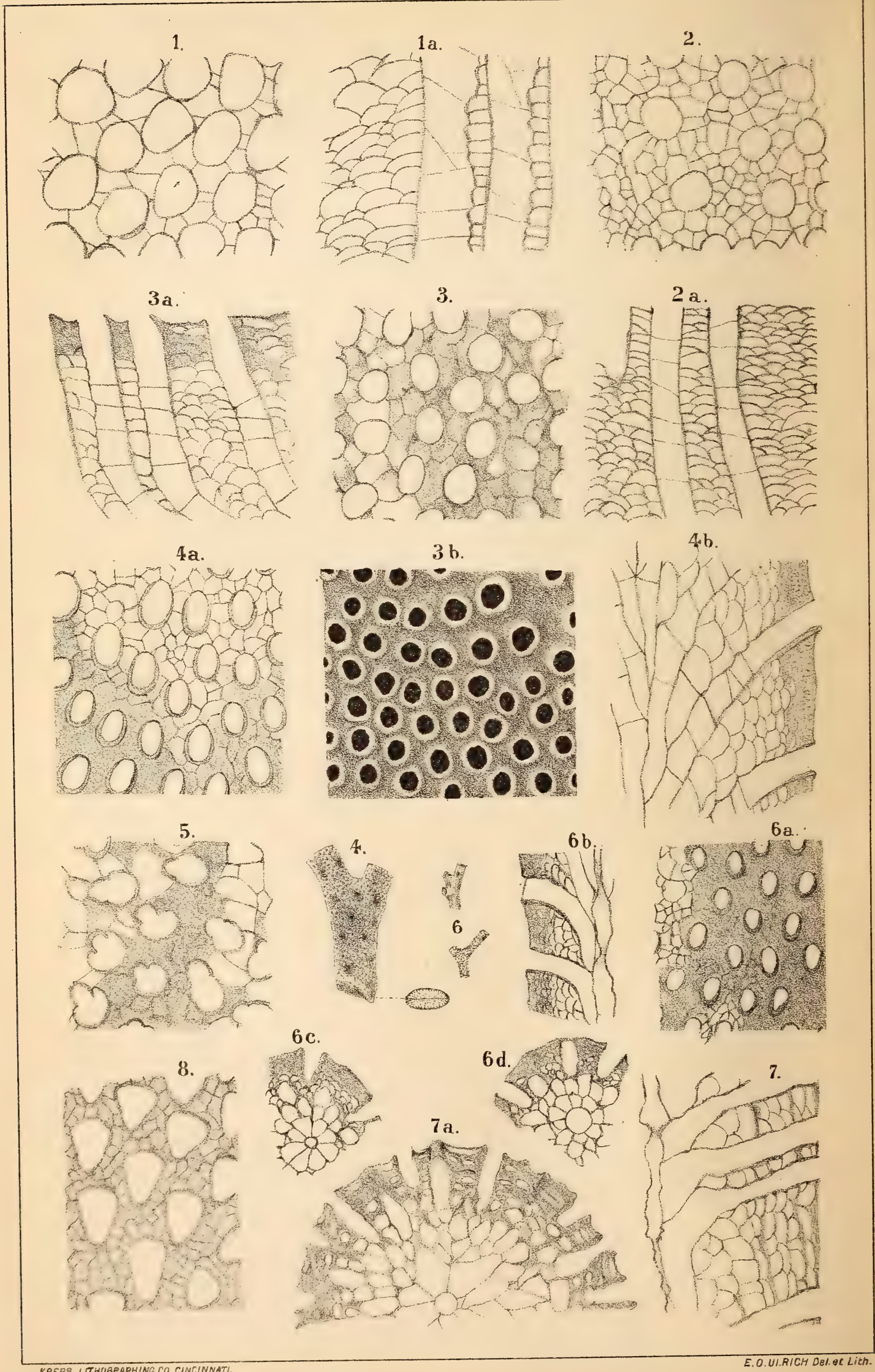

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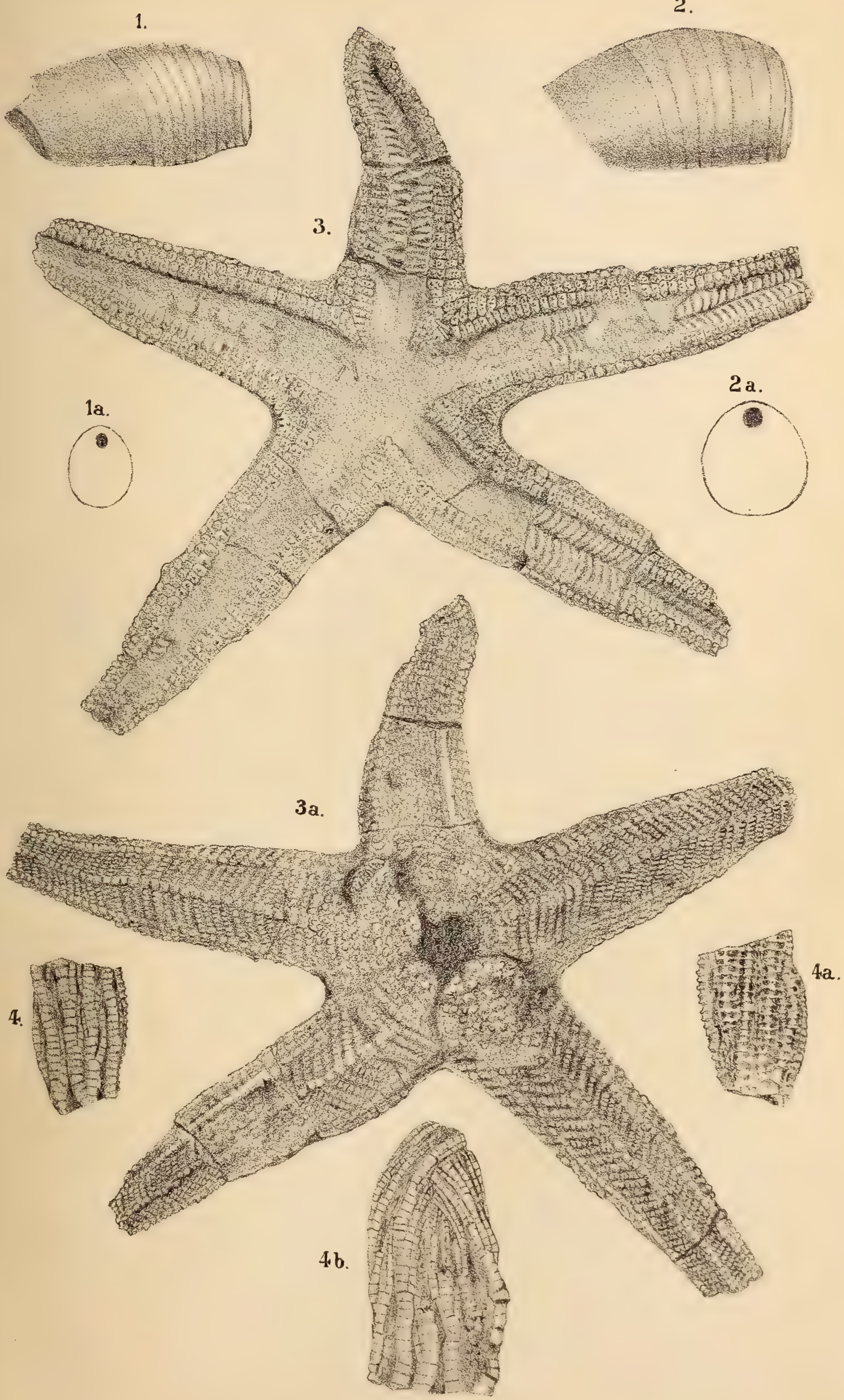
PLATE III.

Unless otherwise designated, all the figures are magnified 18 diameters.

PLATE IV.

		PAGE
Fig. 1.	GOMPHOCERAS CINCINNATIENSE, n. sp. Lateral view, natural size, .	19
1*a*.	A transverse section.	
Fig. 2.	GOMPHOCERAS FABERI, n. sp. Lateral view, natural size, . .	19
2*a*.	A transverse section.	
Fig. 3.	PALÆASTER MAGNIFICUS, n. sp. Ventral view, natural size, . .	16
3*a*.	Dorsal view of the same specimen, natural size.	
Fig. 4.	HETEROCRINUS CONSTRICTUS, Hall. Fragment, natural size, . .	18
4*a*.	Opposite side of the same specimen, showing the peculiar change that has taken place, that led to the mistake of calling it by a different specific name.	
4*b*.	The upper end of the head of another specimen, showing the armlets, or smaller arms.	



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THE JOURNAL

OF THE

CINCINNATI SOCIETY OF NATURAL HISTORY.

VOL. VII. CINCINNATI, APRIL, 1884. No. 1.

PROCEEDINGS OF THE SOCIETY.

TUESDAY, *January* 8, 1884.

BUSINESS MEETING.

President Hunt in the chair. Twelve members present.

The name of Harvey Tilden, Esq., was proposed for membership.

The minutes of the Executive Board for October, November and December were read.

Dr. W. A. Dun read a paper on "Recent Explorations of Mounds in the Scioto Valley." The Doctor exhibited a series of specimens obtained in excavating a mound on Deer Creek, in Ross county, Ohio, including a skull, which, from its form and position in the mound, the Doctor thought a mound-builder skull. A detailed description of the cranium was given by the Doctor, who also read a minute account of the jaws and teeth, by Dr. E. G. Betty.

The paper was referred to the Publishing Committee.

Mr. J. R. Skinner called the Society's attention to the fact that the hieroglyphic upon the edge of the Richardson tablet at Wilmington, Ohio, is the same as the symbol of the Aztec god, Ixcoatl.

Mr. J. F. James said that the peculiar flattening of the skull mentioned by Dr. Dun, he had also observed in a specimen from near Memphis, Tenn., which was said to be found associated with earthen pots. bearing dates of 1654 and 1708. He also spoke of the flint arrow or spear points from the Madisonville Cemetery being of a single type, and almost uniformly without notches.

Dr. O. D. Norton read a poem entitled "Recollections of a Stray Yankee; an unscientific jingle."

Donations were received during the month as follows:

From Natural History Society, Toronto, Label List of Insects of Canada; from Jos. F. James, Constitution of the Mechanics' Institute of San Francisco; from S. A. Forbes, Normal, Ill., Report on the Noxious and Beneficial Insects of Illinois, 1882; from Department of Agriculture, Illinois, sixth, seventh, eighth, ninth, tenth and eleventh Annual Reports of State Entomologist; from Smithsonian Institution, Proceedings of U. S. National Museum, Nos. 16, 17, 18, 19, 20; from J. A. Lintner, Albany, N. Y., 1st Annual Report on Insects of New York, 1882; from Chief Signal Service Officer, Weather Review, October, 1883; from Hugo Mulertt, The Gold-fish, and Model of Carp Pond; from U. S. Fish Commission, Bulletin Nos. 26, 27, 28, 29, 30, 31, 32; Society Nat. Sciences, Mexico, La Naturaleza, Vols. 1, 2, 3, 4, 5, and Vol. 6, Nos. 1 to 19; from S. W. Ely, Specimen of Fungus, *Polyporus applanatus.*

Adjourned.

TUESDAY, *February* 5, 1884.

SCIENTIFIC MEETING.

President Hunt in the chair. Twelve members present.

Mr. W. H. Knight read a paper on "The Motions of the Fixed Stars, and the Number of Dark Stars," with some calculations of the chances of collisions among the stellar bodies.

Dr. W. A. Dun exhibited a collection of relics of the Swiss lake dwellers, and read a paper describing their houses. The houses of the modern Swiss are often built over the water, to economize ground. The ancient lake dwellers probably built in the water not so much for the advantages of defense against enemies as for convenience in landing from their boats, the low shores and shallow waters making a landing difficult from boats.

Prof. Jos. F. James gave an account of some observations on a plant of the common *Caladium.* A growing and expanded leaf was cut from a healthy plant, and almost immediately a jet of water was expelled with some force from the apex of the unfolding leaf. The movement of the fluid continued with a rhythmical movement of 180 pulsations per minute, decreasing to 90 per minute, during several hours.

Dr. Dun thought that the phenomenon came under that known as the rhythmical movement of protoplasm, and suggested that the matter be referred to Dr. Burdon Sanderson, of London, whose studies in that direction have been exciting attention.

Mr. I. H. Harris, of Waynesville, Ohio, was proposed for, and Mr. Harvey Tilden elected to, membership.

The President said that he had by request appointed a committee, consisting of M. D. Burke, L. M. Hosea, L. S. Cotton, Davis L. James and Dr. R. M. Byrnes to represent the Society on the General Committee of Arrangements for the reception of the American Institute of Mining Engineers, which holds a meeting in the city, beginning February 19.

Mr. Cotton, of the committee, stated he had invited the Institute to visit the Society's museum, and Mr. N. W. Perry, by request, outlined the plans of the committee for the entertainment of the Institute while in the city.

Donations were received as follows:

From Smithsonian Institution, Proceedings U. S. National Museum, Nos. 21, 22, 23, Vol. 6; from Am. Society of Microscopists, Buffalo, Proceedings of 6th Annual Meeting 1883, pamphlet on Micrometry; from E. W. Clark, Chief Revenue Marine, Washington, Arctic Cruise of Revenue Steamer Corwin; from Chief Signal Service, Monthly Weather Review, November, 1883; from Prof. O. T. Mason, Anthropological Notes for November and December, 1883, and January and February, 1884; from E. F. Bliss, 3 specimens of lava from the Azores; from Dr. A. J. Howe, 7 fossil shark's teeth; from F. Egner, Esq., 3 cases of stuffed birds; from the Zoological Garden, Cincinnati, 7 species of animals; from Charles Dury, 74 species *N. Am. Coleoptera;* from H. C. Stewart, 1 malformed hen's egg.

Adjourned.

TUESDAY, *March* 4, 1884.

SCIENTIFIC MEETING.

President Hunt in the chair. Fifteen members present.

Mr. Charles Dury read a paper on "North American Hares." Twenty-two species and varieties were named and described, and their peculiarities and geographical distribution commented upon. The real rabbit, *Lepus cuniculus*, is not a native of America. The common cotton-tail or rabbit, *Lepus sylvaticus*, and its varieties, is a true hare, does not burrow, and lives in a form on the surface of the ground.

Mr. Dury exhibited a skin of the jackass rabbit, *Lepus callotis*, taken by himself in New Mexico. *L. campestris*, the prairie hare, is often mistaken for the jackass rabbit, and is so called in Kansas and Colorado. *L. callotis* is a Southern species, found in Texas and New Mexico. The flesh of *L. callotis* is coarse and unpalatable. Mr. Dury measured the tracks of this species, and found that the animal covered twelve feet at a jump.

The little sage hare, *Lepus nuttali*, is very good for food, providing the animal be drawn immediately after being killed. This species feeds on sage brush, and the contents of the intestines and stomach will flavor the flesh if left in the body after death for even a few hours. The curious habit of the male of *L. bairdi* was mentioned. The existence of a mammary gland secreting milk to provide for the young, is a wonderful and exceptional fact.

Remarks were made upon the paper by Messrs. J. F. James, Morgan and Young.

Prof. Jos. F. James read an abstract of a paper embracing "Notes on some Plants of the Vicinity of Cincinnati," enumerating several

species new to the flora. He also showed specimens of *Cardimine* (*Dentaria*) *laciniata*, and *Cardamine* (*Dentaria*) *multifida*, in which the different forms of each so ran together as to be inseparable. The two species should now be referred to *C. laciniata* and var. *multifida*.

Prof. James also read a short note appended by the editor of Science to his communication respecting *Caladium*, read at the previous meeting of the Society, stating that the phenomenon there recorded had been noticed by Musset [1865] and by Munting [1672].

Mr. Davis L. James read a sketch of Mr. T. W. Spurlock, lately deceased.

The papers were all referred to the Publishing Committee.

Mr. I. H. Harris, of Waynesville, Ohio, was unanimously elected to regular membership.

A communication was received from L. E. Warner, Esq., chairman of the local committee on entertainment of the American Institute of Mining Engineers, thanking the Society for its co-operation through its committee.

The following proposition to amend the By-Laws was read:

Proposition to amend the By-Laws of the Cincinnati Society of Natural History—that the following words be added to Section I. of Article VI:

"And all papers shall, before being so published, be read at a meeting of the Society, either in full, by abstract or by title."

The amendment was laid over for one month, as required by the By-Laws.

The President announced that the next meeting would be the annual meeting for the election of officers, and hoped there would be a good attendance.

Donations were received as follows:

From Prof. F. W. Putnam, Abstract of recent Archæological Excursions in Wisconsin and Ohio; from Chief of Signal Service Bureau, Weather Review, December, 1883; from E. M. Cooper, Esq., pamphlet, Flora of Worcester county, Mass.; from Department of Agriculture, three pamphlets on Entomology; from Kentucky Geological Survey, ten pamphlets, viz.: Report of Progress, 1882 to 1884; Peter on Composition of Kentucky soils; Linney on Geology of Lincoln, Mercer, Garrard and Washington counties; Linney on Rocks of Central Kentucky; Linney on Botany of Madison, Lincoln, Mercer, Garrard, Marion and Washington counties; Proctor on Resources of the North Cumberland Valley; Crandall on Geology of Morgan, Johnson, McGoffin and Floyd counties; from F. A. Sampson, of Sedalia, Mo., five pamphlets, viz.: Geological Report on Mineral Lands, Report on Mining and Manufacturing, Natural History of Pettis county, Mo., Notes on Distribution of Shells; from Cornell University, Register 1883-84; from Dr. E. G. Betty, Dental Register, February, 1884; from Charles Dury, Esq., Centipede in alcohol; from Zoological Garden, Cincinnati, 16 specimens of animals, Tenth Annual Report of the Garden.

Adjourned.

012 — 013
X 0055 mm.

BOLETUS MUTABILIS, MORG.

THE KREBS LITH CO. CINCINNATI.

THE MYCOLOGIC FLORA OF THE MIAMI VALLEY, O.

By A. P. Morgan.

[*Continued from vol. vi., p.* 199.]

ORDER II.—POLYPOREI.

Hymenophore inferior, porose. Pores bearing the basidia and cystidia on their inner surface; basidia 4-sporous at the apex.

TABLE OF GENERA OF POLYPOREI.

A. Tubules forming a distinct stratum.

1. Boletus.—Tubules easily separable from one another.
2. Polyporus.—Tubules not separable from each other.

B. Tubules sunk in the substance of the pileus.

3. Trametes.—Pores round, obtuse, entire.
4. Dædalea.—Pores sinuous, labyrinthiform.
5. Favolus.—Pores alveolar, elongated.

C. Pores superficial.

6. Merulius.—Pores formed by reticulate folds.
7. Porothelium.—Pores immersed in discrete warts.
8. Solenia.—Pores in discrete tubules.

Genus I.—Boletus, Dill.

Tubules in a porose stratum without a trama, easily separable from each other, and from the hymenophore. Spores normally fusiform. Fungi terrestrial, fleshy, putrescent, stipitate; the stipe central.

Series I.—Euchroi.

Tubules colored from the first, not white or gray.

A. Tubules ferruginous.

1. B. piperatus, Bull.—Pileus convexo-plane, glabrous, a little viscid, reddish-yellow or brownish. Stipe slender, even, fragile, concolorous. compressed, the base yellow. Tubules decurrent, ferruginous; the pores large, angular. Spores brown, elliptic, .007—.008×.004 mm.

On the ground in open woods, in autumn; rare. Pileus 1-3 in. broad, stipe 1-3 in. long, and $\frac{1}{4}$-$\frac{1}{2}$ of an inch thick. This species is at once distinguished by its peppery taste; the pileus is moist or even viscid, when young; the flesh is yellowish.

B. Tubules yellow, pores the same color.

a. Flesh changing to blue.

2. B. CHRYSENTERON, Bull.—Pileus convexo-plane, soft, floccose-scaly, brownish or reddish; flesh yellow, red beneath the cuticle. Stipe nearly equal, rigid, fibrose-striate, scarlet or yellow. Tubules nearly adnate; the pores large, angular, unequal, greenish-yellow. Spores olive, fusiform, .012—.013×.004 mm.

In woods about the roots of trees and in mossy places, in spring and early summer; common. Pileus 1½-3 in. broad, stipe 2-3 in. long, and ¼-½ of an inch thick. The pileus is often areolate-rimose, and then the cracks are scarlet; the color is some shade of red, olive or yellow; it is sometimes nearly glabrous; the flesh is yellow, changing slightly to blue when cut or broken; the stipe is slender, more or less streaked with red, and often crooked.

3. B. RADICANS, Pers.—Pileus pulvinate, dry, subtomentose, cinereous or olivaceous, then reddish-yellow; the margin thin, involute. Stipe tapering downward and rooting, even, yellow with a reddish bloom, darker when this is rubbed off. Tubules adnate; pores unequal, large, yellow. Spores olive, fusiform, .011—.013×.005 mm.

On the ground in woods, in summer; rare. Pileus 2-2½ in. broad, the stipe about 2 in. long and ½ an inch thick. The pileus is quite firm and dry, becomes reddish or brownish yellow and nearly glabrous; minute reddish scales are sprinkled over the yellow surface of the stipe; the latter tapers downward to a point which penetrates the ground a little distance; the flesh is pale yellow, but I have not observed any bluish tinge, although this is said to appear in the European species.

4. B. MUTABILIS, n. sp.—Pileus compact, then soft, convex, then expanded and depressed, dry, subtomentose, brown. Stipe stout, solid, flexuous, somewhat sulcate, yellowish beneath the brown-punctate scales. Tubules adnate or somewhat decurrent; the pores large, angular, unequal, some of them compound, yellow changing to greenish-yellow. Spores olive, fusiform, .012—.013×.0055 mm. Flesh yellow changing to blue when broken. (See Plate I.)

In shady woods, in summer; not uncommon. Pileus 2½-4 in. in diameter, and ¾-1 in. thick, the tubes occupying about one half the thickness; stipe 2-3 in. long, about ½ in. thick in the middle, and increasing in thickness above and downward. The flesh in both the stipe and pileus is a beautiful bright yellow, which changes promptly,

to blue when broken. A shade of yellow sometimes appears beneath the brown of the pileus, and as the plants grow old, the pileus becomes blackish, glabrous and shining.

b. Flesh unchanged.

5. B. SUBTOMENTOSUS, Linn.—Pileus pulvinate-expanded, soft, dry, villous-tomentose, somewhat olivaceous, concolorous beneath the cuticle. Stipe stout, somewhat costate sulcate, under a lens punctate-scabrous. Tubules adnate; the pores large, angular, yellow. Spores olive, fusiform, .012—.013×.005 mm.

In woods about old stumps and logs, in summer and autumn; common. Pileus $1\frac{1}{2}$-3 in. broad, stipe 2-3 in. long, and $\frac{1}{4}$-$\frac{1}{2}$ an inch thick. In size and habit this species very much resembles *B. chrysenteron;* when the pileus is rimose, the cracks are of the same color as the flesh or the cuticle, and not red; the flesh is white or pallid, growing yellow by exposure.

6. B. AURIPORUS, Peck.—Pileus broadly convex, dry, most minutely tomentose, grayish-brown, sometimes tinged with red. Stipe equal, firm, solid, smooth. Tubules plain, or nearly so, adnate or somewhat decurrent; the pores medium, round, bright golden yellow. Spores olive, fusiform, .012×.005 mm. Flesh white, unchangeable.

In woods in summer; scarce. Pileus 2-3 in. broad, stipe 2-4 in. long, and $\frac{1}{4}$-$\frac{1}{2}$ an inch thick. The plant I have so referred has a slight greenish tinge in the white flesh next the pores in the section; the stipe is red above and yellow below.

C. Tubules yellow, the pores red.

7. B. MAGNISPORUS, Frost.—Pileus firm, pulvinate, tomentose, golden yellow. Stipe slender, long, yellow above and red below. Tubules scarcely adnate, greenish-yellow; pores minute, even, cinnabar-red. Spores .016—.017×.006 mm.

In woods, in summer; rare. Pileus $2\frac{1}{2}$-$3\frac{1}{2}$ in. broad, stipe 4-5 in. long. The tomentum of the pileus is sometimes brownish-yellow; the flesh is greenish-yellow, changing to blue when cut or broken.

8. B. VERMICULOSUS, Peck.—Pileus broadly convex, dry, smooth, or most minutely tomentose, grayish-brown tinged with red. Stipe equal, solid, smooth, paler than the pileus. Tubules plane or slightly convex, free; the pores small, round, yellow, brownish-orange, becoming almost black. Spores fusiform .011—.014×.004mm. Flesh white, changing to blue.

In low, damp places in woods, in summer; rare. Pileus 3-4 in. broad, stipe 3-4 in. long, and $\frac{1}{2}$-$\frac{3}{4}$ of an inch thick. I found my specimens in very dry weather, and they were quite firm and not infested by the larvæ of insects. In the younger specimens there is some red on the stipe and within; the pileus becomes thick and the pores change to blackish as the plant grows old.

SERIES II.—TEPHROLEUCI.

Tubules at first white or gray.

D. Changing to brown.

9. B. STROBILACEUS, Scop.—Blackish-umber. Pileus pulvinate, imbricated with thick floccose scales. Stipe equal, veiled, sulcate at the apex. Tubules adnate; the pores large, angular, whitish-brown. Spores blackish-brown, nearly globose, .010—.013 mm. in diameter.

On the ground in dry woods, in summer; common. Pileus 2-4 in. broad, stipe 3-4 in. long, and $\frac{1}{2}$-$\frac{3}{4}$ of an inch thick. In this species the scales are imbricate, and the tubules are adnate by their whole length. The flesh when cut or broken becomes reddish or blackish.

10. B. FLOCCOPUS, Vahl.—Cinereous, at length blackish. Pileus pulvinate, soft, covered with an areolate-fasciculate, scaly-squarrose tomentum; veil silky thick, annular-appendiculate. Stipe stout, umber-tomentose below, lacunose above. Tubules abbreviated behind; the pores large, white-gray. Spores blackish, nearly globose, .009—.010 mm. in diameter.

On the ground in dry woods, in summer; common. Pileus 3-5 in. broad, the stipe 4-5 in. long, and $\frac{3}{4}$-1 in. thick. This species is distinguished by the tomentum raised into thick, erect, pointed tufts, and by the tubules being depressed around the stipe. These black *Boleti* are abundant in our woods, and probably there is hardly enough difference between them to warrant two species. They seem to be scarce in Europe; they are the *Strobilomyces* of Berkeley.

E. Changing to sordid.

11. B. SCABER, Fr.—Pileus pulvinate, glabrous, viscid when wet, at length rugulose or rivulose; the margin at first curtained. Stipe solid tapering upward, rough with fibrous scales. Tubules free, convex, white then sordid; the pores minute, round. Spores pale brown, fusiform, .014—.015×.0055 mm.

In hilly woods in summer; rare. Pileus 3-5 in. broad, the stipe 3-5 in. high, and $\frac{1}{2}$-1 in. thick. The few depauperate specimens I have

thus far found in this locality scarcely reach the smallest of these dimensions. No species is more abundant in the mountains; it is there the common *Boletus*. Its colors are various, from gray to orange and brown; it is easily recognized by its shaggy stipe.

12. B. SORDIDUS, Frost.—Pileus pulvinate, somewhat tomentose. Stipe solid, somewhat flexuous, striate, smaller as it enters the pileus, generally greenish at the apex. Tubules long, nearly free, white, then sordid; the pores large, angular. Spores dirty-brown, fusiform, .011—.013×.0055 mm.

In damp woods, in summer and autumn; not uncommon. Pileus 2-3 in. broad, stipe 2½-3 in. long, and about ¼ of an inch thick. The flesh is white, sometimes tinged with red and green; the tubules change to bluish-green when bruised. This is no doubt Mr. Frost's plant, but our specimens are much finer than his typical ones. His description is rather imperfect, but the agreement of the spores and otherwise is very close.

F. Changing to flesh-color.

13. B. FELLEUS, Bull.—Pileus pulvinate then expanded, soft, glabrous, even, brownish or reddish-gray. Stipe solid, tapering upward and reticulate. Tubules adnate, convex, elongated; the pores angular, white then flesh-color. Spores rose-color, fusiform, .016×.005 mm.

In dry woods in summer; common. Pileus 4-6 in. broad, stipe 4-6 in. long, and about 1 in. thick. The bright rosy spores at once distinguish this common species; the dimensions given are about those of the plants met with in this region; the flesh is white or pale flesh-color; the taste is bitter.

14. B. GRACILIS, Peck.—Pileus convex, dry, smooth or minutely tomentose, ochraceous-brown. Stipe slender, equal or tapering upward, solid, marked with fine elevated lines which anastomose and form very long narrow reticulations. Tubules plane, depressed about the stipe or nearly free; the pores small, round, whitish then pale flesh-color. Spores flesh-color, fusiform, .013.—.014×.0055 mm.

On the ground in woods, in summer; not common. Pileus 1½-2½ in. broad, stipe 3-5 in. long, and ¼-½ an inch thick. This plant is much more slender than *B. felleus*, and the character of the reticulations on the stipe quite different. Spores that I have kept for some time are somewhat ferruginous in tint. The specimens in this region were all sent me by Mr. Meyncke, of Brookville, Ind.

G. Changing to yellow.

15. B. CASTANEUS, Bull.—Pileus convexo-expanded or depressed, firm, velvety, cinnamon. Stipe stuffed then hollow, tapering upward from a somewhat bulbous base, velvety concolorous. Flesh white, not changing color. Tubules free, short, white; the pores minute, round. Spores yellow, subelliptic, with an oblique apiculus, .008—.010× .0055 mm.

In hilly woods, in summer; common. Pileus 2-2½ in. broad, stipe 2½-3 in. long, and ½-¾ of an inch thick at the base. The chestnut color varies from pale to dark; the texture is quite dry, not fleshy or juicy; the tubules finally take on the pale yellow color of the spores.

16. B. EDULIS, Bull.—Pileus pulvinate, glabrous, moist, brownish. Stipe stout, reticulate, brownish-pallid. Tubules semi-free, elongated; the pores minute, angular, white then yellow or greenish. "Spores large, greenish ochre."

On the ground in woods, in summer; rare. Pileus 3-6 in. broad, stipe 4-6 in. long, and 1-1½ in. thick. The flesh is white, turning a little reddish near the epidermis, at first compact, then softer. It is a stout, fleshy *Boletus*, said to be delicious eating. It is thought to be the *Suillus*, which, on the testimony of Pliny, his countrymen were in the habit of fetching from Bithynia; it is the modern *Porcino* which is sold in strings, during the winter, in every market place throughout Italy.

ORNITHOLOGICAL FIELD NOTES, WITH ONE ADDITION TO THE CINCINNATI AVIAN FAUNA.

By WILLIAM HUBBELL FISHER.

For certain items of valuable information contained in the following notes, I am indebted to Mr. John W. Shorten, of Cincinnati, Ohio; to Charles J. Crandall, of Otter Lake Tannery, Lewis county, New York; to Francis A. Young, of Otter Lake, Herkimer County, New York.*

FALCO PEREGRINUS NŒVIUS [Gm.], Ridg.—*American Peregrine Falcon*; *Duck Hawk*.—One fine specimen, a female, in immature [probably second] plumage, was taken in September of this year [1883], within the limits of Cincinnati, Ohio. The cadaver was secured by John W. Shorten, and the skin is now in my collection.

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* The nomenclature followed herein is that by Prof. Robert Ridgway in his paper of the nomenclature of North American Birds, Bulletin No. 21 of 1881, of the National Museum.

This is the first recorded instance of its capture in the State of Ohio, south of Columbus, Prof. J. M. Wheaton, in his Report on Birds of Ohio, in Report on Geological Survey of Ohio, vol. 4, p. 423, published in 1882, speaks of this bird as "not identified in Southern Ohio."

Astur atricapillus [Wils.], Bp.—*American Goshawk.*—This bird, a female, in immature plumage, was taken during November, 1882, within the limits of Cincinnati, *fide* Shorten. The skin is in my collection. This is the second bird of this species whose capture in Southern Ohio is recorded. The facts as to the first bird of this species are noted * by Dr. F. W. Langdon, on the authority of Mr. Charles Dury, as follows : "A single specimen, female, in immature plumage, taken twenty miles east of Cincinnati, in November, 1878." It is interesting to observe the following coincidences, viz.: that both of these birds are young females, and both were taken in the same month of the year, viz.: November.

Loxia curvirostra americana [Wils.], Coues.—*American Cross-bill.*—At the settlement known as Otter Lake Tannery, Lewis county, N. Y., on Friday, September 28, 1883, I met Mr. Charles J. Crandall, residing there, and he informed me that this species of birds were exceedingly fond of salt. He pointed out a spot in the rear of the grocery, where the refuse salt from the barrels from which the pork had been taken was usually thrown, and stated that the Cross-bills were accustomed to come daily in numbers and feed upon the refuse salt—that latterly the birds had been somewhat shy, having been repeatedly driven away by the boys, who had begun to throw stones at them. On the evening of the same day I reached the little house of Francis A. Young, on Otter Lake, in Herkimer County, N. Y., and on my mentioning what Mr. Crandall had said, respecting the fondness of the Cross-bills for salt, Mr. Young corroborated the statement, and informed me that these Cross-bills came around his house for a similar purpose. Early the next morning, about an hour after sunrise, I found the Cross-bills began to perch upon that side of the peaked roof of his house which was next to where the refuse salt and other matters were thrown out. I killed one, and afterwards took two more perching upon the roof. Later, I saw a flock of some seven perching on the same side of the roof. While all the other descriptions of birds, of which a great variety was present, remained in the trees, the Cross-bills perched on the roof of the house, except when frightened away by the too near discharge of the gun.

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* See Cat. of Birds of Cincinnati, 1879, by Frank W. Langdon, p. 14, No. 159.

Lanius borealis [Viell].—*Great Northern Shrike.*—While at Lyons Falls, Lewis county, N. Y., on August 28, 1883, at about 12:30 p. m., on my return from a collecting excursion, near a large barn on the Lyon estate, I noticed a large flock of birds near the ground, and, on my nearer approach, a Shrike (from its large size probably the Great Northern Shrike), suddenly arose from the ground, and perched upon a fence about thirty-five yards distant from where I was. He was beset by this flock of birds, consisting of about a dozen bobolinks, and as many sparrows. The action of these birds indicated bitter hostility to the Shrike. They circled around him savagely, chirping and darting down at him. He squatted low on the top of the fence, and attempted to parry their attacks. Twice he came near tumbling off the fence in his endeavors to defend himself, quick flits of his tail serving to aid him in recovering his lost balance. After a few moments he appeared to give up the contest, and darted quickly away over the marshy meadow, with the attacking birds in full pursuit. I soon lost sight of all the participants in this, to me, strange chase.

Bubo virginianus [Gm.], Bp.—*Great Horned Owl.*—In Dr. F. W. Langdon's Miscellany, Vol. v., No. 2., of the Journal of the Cincinnati Society of Natural History, page 94, mention occurs of the taking of two young birds of this species in the nest, near Brookville, Indiana, on April 16, '82, and that one of these birds was larger than the other. The skins of these birds have recently come into my possession, and observing quite a marked difference in the size, I wrote to Edgar R. Quick, the collector of them, asking him his opinion as to the cause of such difference. Under date of December 2, '83, he replies: "The nest was situated about two miles southwest of Brookville, in the hollow of a large white oak, about thirty feet from the ground. I shot the old one, and climbed to the nest, where I found the young which you speak of, then in the downy stage of plumage. The difference in size was then very marked. My theory to account for this fact was formed from my experience in feeding the birds, which I kept for some time afterward. In the first plac , the eggs were laid in cold weather, and the female must necessarily have to sit on the first egg as soon as it was laid; then, owing to the tardy action of nature's forces at that time of year—probably the latter part of February—the second egg was probably laid some days after. Thus the birds would hatch at different times, and the older of the two would be the stronger, and in the struggle for life, would get the most food. It was my experience that if food was given to them in-

discriminately, the younger got a very small share, until the larger was satisfied, which was seldom the case, unless food was plenty."

NOTE.—It is to be regretted that the sex of each of these birds was not ascertained by dissection at the time of their death. In the opinion of Mr. Chas. Dury, the difference is not greater than might be accounted for by sexual variation.

IN MEMORIAM—THOMAS W. SPURLOCK.

(Read and referred March 4, 1884.)

Thomas W. Spurlock was born in the village of Cedarville, King William county, Virginia, on the 15th of January, 1803. He learned the trade of a shoemaker, and worked at different times in Richmond, Lynchburg and Fredericksburg. He married about 1831, Miss Martha Ann Davis, and in November, 1836, he moved to Cincinnati, where he lived until his death. He followed his trade until about 1850, when he was engaged by Mr. Harwood, of the firm of Marsh & Harwood, to work in their chemical laboratory. He was employed in the manufacture of sulphuric acid, and continued in that department of the works until about twelve years ago, when his advanced age compelled him to give up active labor. From that time he lived with his son in-law, Mr. Henry Ambach, on Mohawk street, till he died, of pneumonia, on the 19th of January, 1884, aged 81 years and 4 days.

Mr. Spurlock's deep love for botanical studies, and his general interest in all branches of natural science, together with his contributions to the flora of Cincinnati, entitle him to a notice before this Society.

As a young man, he was fond of hunting, and in his rambles near his native place developed a love for nature which never relaxed its fervor, and which was as warm in his old age as in middle life. Even in his last hours his mind wandered among the wild flowers and ferns, and planned excursions to catch the first blossoms of the coming season.

In Virginia he had studied the flora of the region where he was born, and the recollection of the plants he had known there was dear to him. The discovery of a familiar plant was like meeting an old friend, and his face would beam with delight as he displayed his new-found treasure. His companion in his rambles in bygone years was Dr. Thomas Salter, who kept a drug store at the corner of Ludlow

and Second streets. In later years his botanical excursions were sometimes made in the company (though he usually went alone) of Dr. C. J. Funck and Dr. R. M. Byrnes. Dr. Salter seems to have been an intimate friend, to whom Mr. Spurlock looked for companionship in his studies, and to whose herbarium he made many contributions.

During the eight years' acquaintance which the writer enjoyed with Mr. Spurlock, scarcely a week passed that he did not bring him some rare or beautiful plant. He never collected for himself. He gave freely to his friends the results of his herborizing. He admired plants as they grew. Unlike most collectors, he cared more for their preservation in the woods, the fields or on the hillsides than in herbaria. He

"Loved the wood rose and left it on its stalk."

He often refused to give information as to the locality of a rare plant, for fear some ardent collector would destroy it and it might not appear again. He watched even the most insignificant with as much care as a gardener watches his choicest varieties.

From its first budding to its fruiting the vilest weed, if rare, was the subject of his constant attention, and when the seed had matured, he carefully gathered and scattered it in new places, in the hope—often vain, indeed—that it might germinate, and thus a rare species would be preserved to our flora. It was a favorite scheme of his to place the homely Jamestown weed (*Datura stramonium*) with the beautiful flowered *Datura meteloides.* He scattered many seeds on the hillsides and in the quarries, and though they germinated, the beauty and fragrance of the flowers were the destruction of the plants, and the plan, as might have been expected, failed. Less worthy, though as characteristic, was his endeavor to establish the *Xanthium spinosum* and *Dysodia chrysanthemoides*, and more fortunate for us that he was unsuccessful. He desired to have unusual plants near him, where he could readily get to them, watch them grow and flower and gather a few now and then to please his botanical friends.

The ferns Mr. Spurlock dearly loved and admired. It was a constant source of regret that the rapid spread of the city was destroying the places in which they grew. The locality of a rare species was to him a Mecca demanding a yearly pilgrimage, and how deeply he felt the destruction of such a locality can only be known to those who have heard him gravely complain of his misfortunes.

When botanizing with Mr. Spurlock, he said to the writer: "Come, and I will show you where the New York fern grows." (It is rare in

this region.) He led the way to a small grove of noble beeches, and on a little mound made by the roots of a prostrated tree, lay the remains of a few plants, the fronds broken and crumpled. Tenderly, as if caressing a child, the old man smoothed out the leaves and mourned over the injured plant, sighing at the thought that it might not revive again.

In the latter part of August, 1883, he found a few plants of *Cassia occidentalis*, on the Ohio and Mississippi Railroad below Millcreek It is an extra limital species, and had never been observed here before. Our old friend's interest was excited. He took botanists to see the plants and visited the spot regularly once a week, until on October 18th he brought a well flowered specimen carefully wrapped in wet cloths, and with a smiling face and twinkling eye, gave it to the writer, with the injunction to press it carefully for an herbarium specimen. He now watched for the seeding, and one day came to say that the section men had almost destroyed his flowers, but that he had saved one broken specimen. This he planted in a pot, bandaged the broken stem carefully, and faithfully watched it till the seed matured. These he saved, and with a generosity so characteristic of him, he brought the two legumes to us and asked us to open one, give him two or three seeds, and keep and plant the remaining ones.

Mr. Spurlock left no herbarium and no notes of his observations, but he did leave to those who knew him the fragrant recollection of a pure, simple love of nature, which in a less modest or more aggressive man would have blossomed forth in work of permanent value. Local botany owes much to him, and his loss will long be felt by those who knew his kindly ways. He found many plants which are named in the Cincinnati Flora of Mr. Jos. F. James, and discovered not a few which, from their retiring habits, had been thought extinct in the vicinity.

He was also a collector of fossils, and many of the collections of the city have been enriched by his "finds." He added to the pleasure of finding that of giving. The rare trilobite *Proteus spurlocki* was found by him and presented to Mr. C. B. Dyer, and the beautiful polyzoan *Ptilodictya shafferi* was first found and given by Mr. Spurlock to the gentleman whose name is honored in connection with it.

Mr. Spurlock was a very modest and retiring man, quiet in manner and pleasant in conversation when he could be drawn out. He was entirely self educated, had been a great reader, and had a fund of general knowledge which was surprising in a man of his opportunities.

He was well acquainted with the medicinal qualities of herbs, and had considerable knowledge of chemistry and medicine.

In person he was short, spare, and stooped with age, brisk in his movements, and walked usually with a cane.*

He was a life-long member of the First Baptist Church. Uniting with that congregation when he first came to the city, he continued a constant attendant till his death. He was licensed by his church in 1842, and has more than once served in the capacity of preacher. He never obtruded his religious opinions upon any one. He was a simple-hearted believer in Christianity, who "looked through nature up to Nature's God," and saw in the humblest flower "the revelation of His love." To one who visited him in his last illness, he said that with St. Augustine he could say, "*Spes mea Christus.*" In this hope he died. With us he still lives in memory as a man whose love for nature was pure and childlike, and beyond any expectation of gain.

DAVIS L. JAMES.

DESCRIPTION OF A BEAUTIFUL STAR FISH AND OTHER FOSSILS.

By S. A. MILLER.

PALÆASTER MAGNIFICUS, n. sp.

(Plate IV., Fig. 3, ventral view, natural size; Fig. 3*a*, dorsal view of the same specimen, natural size.)

This is a very large species, from the Lower Silurian rocks, equaled in size only by *P. dyeri*. It is founded upon a free specimen showing both the dorsal and ventral sides, and nearly all the characters except the madreporiform tubercle, which can not be fully distinguished. The rays have been broken and mended, as shown in the illustration, and some of the parts are not in their proper places, but this does not detract very largely from the value of the specimen.

The diameter or breadth of the disc is one and one fourth inches, and the distance from the point of one ray to the point of the opposite one, if the rays were wholly preserved in the specimen under examination, would be fully six inches. It may be distinguished from *P. dyeri* by having proportionally a smaller disc and more slender and elongated rays.

The plates upon the dorsal side are very convex, and part of them,

* His favorite walking stick was a woody stem of *Artemisia*.

at least, were spine-bearing, though it would seem that there was not more than one spine upon any single plate. The arrangement of the plates on the dorsal side of the rays is very ornamental. A single series of highly convex or conical plates, larger than the others, and each evidently bearing a central spine, occupies the middle of each ray; on either side near the margin of each ray there is a similar series, and the two intervening spaces are filled with smaller, convex plates, arranged in rows which are directed diagonally forward from the plates of the side series to the plates of the central series, forming angles with each plate in the central series occupying an angle. This disposition of the plates on the dorsal side of the rays will, so far as known, serve to distinguish this species from any hitherto described.

The plates covering the dorsal side of the body or disc have been so much disturbed, in our specimen, that one can not correctly define them.

The ventral side is obscured by adhering earth in some parts, but most of the characters can be ascertained. The ambulacral furrows are wide. The marginal plates are hexagonal, about the size of the larger plates on the dorsal side of the rays, and separated from the side series by intervening smaller plates. Each bore several small spines, as shown by the small pits for their articulation, beside some of them are now preserved in our specimen. The spines upon the plates in each axilla or junction of the rays are larger than those toward the apices of the rays.

The adambulacral plates are hexagonal and much wider than long. They are more numerous than the marginal plates near the disc, but toward the apices of the rays they alternately interlock with the marginal plates. The number on each side of a furrow in a complete ray would be fifty or more. The pits for the articulation of the spines are as numerous as they are on the marginal plates. These two series on the ventral side of the species, with numerous spines upon each plate, are in striking contrast with the plates on the dorsal side of the rays, where no plate bears more than a single spine.

The ambulacral plates have their greatest length across the rays, and seem to be about as numerous as the adambulacral ones. An angular depression marks the center of each ambulacral furrow, upon each side of which a sharp ridge arises, upon each ambulacral plate, and curving forward and outward abuts against an adambulacral plate. The ambulacral ossicles articulated upon the commencement of the

sharp ridges upon each side of the angular depressions. There are only a few of these ossicles preserved on our specimen, and they may be described as rather small club-shaped pieces. They are not half as large as those belonging to *P. dyeri.*

This magnificent species can hardly be mistaken for any other, as it is very distinct in all its characters. The specimen is from the collection of I. H. Harris, of Waynesville, and was collected in the upper part of the Hudson River Group of that locality.

Heterocrinus constrictus (Hall).

(Plate IV., Fig. 4, fragment, natural size; Fig. 4*a*, opposite side of the same specimen, showing the peculiar change that has taken place, that led to the mistake of calling it by a different specific name; Fig. 4*b*, the upper end of the head of another specimen, showing the armlets or smaller arms.)

Fig. 4 represents this species as it is usually found. Fig. 4*a* is the opposite side of the same specimen, and shows the characters that misled Prof. Wetherby into describing it as a new species under the name of *Heterocrinus vaupeli.* The metamorphosis or peculiar mineral change that has taken place is calculated to deceive any one on first inspection, and it is to the credit of Prof. Wetherby that he was able, from his specimen alone, to compare it even with *H. constrictus*, to which it belonged. This peculiar change may have taken place during life. Several specimens are now known showing it in a greater or less degree, which belong to this species. The specimen represented by fig. 4*b* shows the change near the end of the arms on one side, but this character is not shown in the illustration. If the change is to be attributed to fossilization, it is unaccountable that we should be unable to find the same change in other crinoids found in the same rocks; but if it occurred during life, it may have been the result of disease that afflicted this species. I have not recognized the peculiarity in other species, but other collectors claim to have seen it in other species belonging to this genus.

Prof. Meek seems to have been in doubt as to whether the smaller branches of the arms in this species should be called pinnules or armlets. Fig. 4*b* is drawn for the purpose of showing better than has heretofore been done, the characters of these smaller branches. They are furrowed, and the furrows are connected with the larger ambulacral grooves. They are not, therefore, pinnules. They may be called armlets, but they are the result of unequal bifurcations of the arms, and are none the less arms because they are smaller than the larger division or main arm. These smaller arms bifurcate at least once, and toward the upper part of the arms they bifurcate twice. These divis-

ions are equal, and hence contrast strongly with the inequality of the first bifurcations. I have been unable to detect any evidence of the existence of pinnules in this species.

Gomphoceras faberi, n. sp.

(Plate IV., Fig. 2, lateral view, natural size; Fig. 2*a*, a transverse section.)

Shell small, very moderately gibbous; ventral side quite convex, longitudinally, and dorsal side nearly straight. Greatest diameter at the second chamber from the body chamber. Transverse section ovoid. Siphuncle of medium size, and close to the ventral margin. Septa very slightly convex and curving slightly forward over the contracted ventral side. Chamber of habitation of medium size, or considerably less than the size of the combined air chambers, and rapidly contracting toward the anterior end.

The specimen illustrated shows seven air chambers. These have a length on the dorsal side of 53-100 inch, and on the ventral side of 80-100 inch. The lateral diameter of the second air chamber is 76-100 inch, and of the seventh, 60-100 inch. The dorso-ventral diameter of the second air chamber is 78-100 inch, and of the seventh, 65-100 inch.

The species was collected by C. L. Faber, Esq., in whose honor I have proposed the specific name. It is either from the extreme top of the hills at Cincinnati, or from Warren county, Ohio, in rocks somewhat higher in the Hudson River Group. It has the appearance of the rocks at the latter elevation, but he is not positive at which locality he collected it.

Gomphoceras cincinnatiense, n. sp.

(Plate IV., Fig. 1, lateral view, natural size; Fig. 1*a*, a transverse section.)

Shell small, moderately gibbous; ventral and dorsal sides convex, longitudinally, the former having the greatest convexity. Greatest diameter at the second or third chamber from the body chamber. Transverse section sub-elliptical. Siphuncle of medium size and close to the ventral margin. Septa very slightly convex and curving a little forward over the contracted ventral side. Chamber of habitation much less than the size of the combined air chambers, and tapering toward the anterior end.

The specimen illustrated shows nine air chambers. These have a length on the dorsal side of 53-100 inch, and on the ventral side of 72-100 inch. The lateral diameter of the second air chamber is 55-100 inch, and of the ninth, 40-100 inch. The dorso-ventral diameter of the second air-chamber is 70-100 inch, and of the ninth, 45-100 inch.

This species is distinguished from *G. faberi* above described, by its

thinner air chambers, sub-elliptical instead of ovoid section, greater convexity of the dorsal side and other peculiarities indicated in the definition.

The specimen illustrated is from my own collection, and was found in the middle part of the Hudson River Group, near the tops of the hills, at Cincinnati. Mr. C. L. Faber has a specimen from the same locality with ten air chambers, and agreeing in size and measurements with this specimen. Other collectors have fragments of the same species from the same horizon.

DESCRIPTION OF THREE SPECIES OF FOSSILS.

By U. P. James.

Genus Stromatopora, De Blainville.

Stromatopora subcylindrica, sp. nov. James.

The form of this species is a subcylindrical tube, somewhat compressed, filled centrally, in this case, with clay. Prominent, conical elevations, varying in height from 1-10th to 1-20th of an inch or more, distributed irregularly over the surface. Radiating lines, more or less conspicuous, occupy the apices and slopes of the prominences, giving

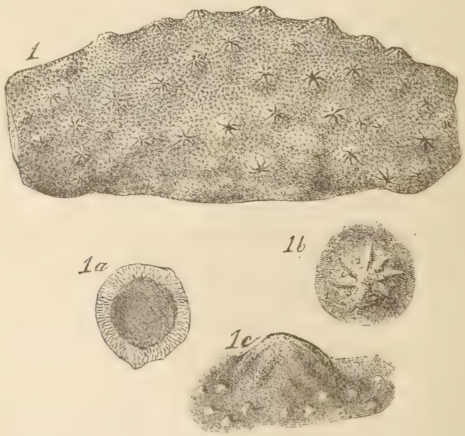

Fig. 1, the type specimen of *Stromatopora subcylindrica*, James, natural size, showing general surface features; 1*a*, transverse section showing the central part filled with clay, natural size; 1*b*, apex of one of the tubercles viewed from above, enlarged, showing the raised lines; 1c, lateral view of 1*b* more enlarged, showing a part of the radiating lines the apex and slopes, and some of the papillæ.

some of them a stellate appearance. On the general surface are shown distinct circular or elongate papillæ, about 1-20th of an inch apart more or less. No oscula or surface pores of any kind observed.

A microscopic section shows an irregular porous structure of the interior of the body.

The specimen used for this description is 2½ inches long, slightly arched on one side and nearly straight on the opposite side; ⅘ths of an inch in diameter at one end, 1 inch in the middle, and ½ an inch at the other end; 1-10th of an inch in thickness from the outer surface to the hollow part. How much longer the specimen may have been is not known, as both ends have a fractured appearance.

Loaned to the writer for description by Prof. R. H. Holbrook, of the National Normal University, Lebanon, Warren county, Ohio. Found near Morrow, in the same county, in the shaly beds of the Cincinnati Group.

Genus Fistulipora, McCoy.

Fistilupora oweni, sp. nov. James.

The corallum of this species grew, apparently, in a very irregular manner, no definite form or outline, from 1-10th to 1-20th of an inch in thickness; in flattened, twisted expansions, sometimes spread out in a lobate form, in other cases anastomosing frequently, and again forming subcylindrical tubes and projections with narrow or hollow spaces —the hollows and spaces mostly filled with clay. The corallites spring from a base covered with a very delicate striated epitheca (see fig. 2*d*). Surface occupied with eight to ten circular tube apertures to 1-10th of an inch, which project conspicuously above the general surface, and show a tendency to an arrangement of five to ten in curved or straight rows sometimes, in other cases placed irregularly. The projecting tubes stand at right angles with the general surface, each tube distinctly separate from other tubes; walls of tubes comparatively thick on one side, but thinning and sloping to the opposite side (see fig. 2*c*). Distributed over the surface are maculæ having a stellate appearance, about 1-10th of an inch apart, and 1-20th of an inch across; the maculæ are generally somewhat depressed; the interstitia spaces, as well as the maculæ, are occupied by more or less *small* pores, but not so numerous as shown in the tangential section. The surface of weathered specimens appear quite different from perfect unworn examples (see fig. 2*c*).

A transverse section of a subcylindrical projection shows the hollow portion filled with clay (see fig. 2*a*). In a tangential section the tubes are seen to be suboval or subcircular in outline, and the small interstitial pores of much the same shapes (see fig. 2*f*).

The best of three *vertical* sections taken from different parts of the same corallum show only obscure (owing, seemingly, to the unusually dark, translucent coenenchyma preventing the passage of light sufficiently distinct) or doubtful tabulæ, and a few convex vesicular attachments to one side of some of the tube walls (see fig. 2*g*). The walls are thin and slightly curved at the base, but just above they become somewhat thickened, and take a direct vertical course to the surface; this section is cut through one of the stellate spaces, which portion shows a different arrangement of the tubes from that described above (see fig. 2*g*).

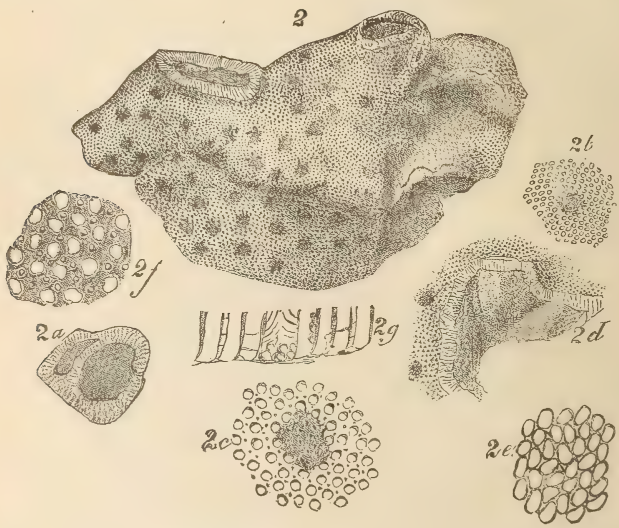

Fig. 2, part of a specimen (type) of *Fistulipora oweni*, James, showing general surface features, natural size; 2*a*, transverse section of a projection, natural size, showing the hollow interior filled with clay; 2*b*, a small portion of the surface slightly enlarged, showing one of the maculæ and tube openings; 2*c*, same as 2*b*, but much more enlarged; 2*d*, the central part of this figure was intended to show the striate epitheca at the base of the tubes, natural size; 2*e*, portion of the surface of a weathered specimen, much enlarged; 2*f*, part of a tangential section, enlarged to about same scale as 2*c* and 2*e*; 2*g*, part of a vertical section, much enlarged, cut through one of the maculæ.

There is some resemblance in the surface markings of this species to *F.* sp. *siluriana*, James, but in habit of growth and other respects they differ widely.

The specimens (fragments) used for this description are of various forms and sizes: the entire corallum must have been of considerable dimensions—probably six or eight inches in diameter and more in height—as all the fragments obtained seemed to belong to one individual: found by the writer in a bed of shale in the vertical section of the bank of a "run" near Lebanon, Warren county, Ohio. It is quite certain that only a part of the complete specimen was secured, and yet enough was got out to make up a good portion of the size mentioned as indicated. Cincinnati Group.

Named in honor of the late Dr. David Dale Owen, the distinguished geologist.

Genus Cerampora, Hall.

Cerampora? beani, James.

Cerampora? beani, James. The *Paleontologist*, page 5, July 2, 1878.

Polyzoary forming thin, irregular expansions, parasitic upon the surface of Orthoceras, and probably other foreign substances. Sometimes in colonies, as shown on fig. 3, in other cases completely covering the body of sections of Orthoceras. The cells have, sometimes, eccentric points from which they radiate, and are arranged in a somewhat quincuncial order in alternating oblique rows; but in other cases they are not so regularly disposed. Cell walls rather thick and not raised above the general surface; apertures slightly oblique in some cases. Cell apertures generally long oval or diamond-shaped, but sometimes quite irregular in form. The best specimens show, occasionally, minute pores at the angles or junctions of some of the cell walls. About three cells in the space of a line measuring the longer diameter, and four or five measuring transversely, except at the radiating points, where they are smaller. In some examples the cells and cell walls resemble the nonporiferous face of the fenestrules and branches of Retipora, but much smaller than any specimens noticed of that genus.

Fig. 3.

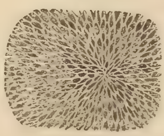

Fig. 3*a*.

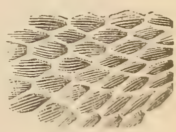

Fig. 3*b*.

Fig. 3, a colony, grown upon Orthoceras, of *Cerampora? beani*, James, natural size; 3*a*, a part of the surface of same specimen enlarged 2½ diameters; 3*b*, a smaller portion of the same enlarged 10 diameters.

Mr. W. H. Bean, of Lebanon, Warren county, Ohio, for whom this species was named, and who furnished the writer with fine specimens, says he has found it "invariably parasitic on the Orthoceras duseri."

The three figures were furnished by Mr. Bean. Drawn and engraved by Mr. J. J. G. Steddom.

Mr. Bean states that the best locality for this species is Hall's Creek, on the the farm of Mr. J. E. Dunham, upper beds of the Cincinnati Group, Warren county, Ohio.

AMERICAN PALÆOZOIC BRYOZOA.

By E. O. Ulrich.

(*Continued from Vol. vi., p.* 279.)

RHABDOMESONTIDÆ, Vine.

Zoaria ramose, branches slender, solid or tubular. Cells of one kind only, tubular, opening on all sides of the branch, with a more or less expanded aperture, forming the so-called "vestibule;" walls usually spiniferous. At the base of the "matured" or thick-walled portion of the zoœcia, the inferior wall is angular, and often produced into an incomplete diaphragm. True diaphragms always few, usually wanting.

This family lately established by Mr. G. R. Vine * includes, so far as known, at least the two genera *Rhabdomeson*, Young and Young, and *Rhombopora*, Meek, and, with much probability, also *Anisotrypa*, Ulrich. The genus *Rhombopora* is well represented in American Palæozoic rocks, and ranges from the Niagara group to the close ot the Coal Measures. Species of *Rhabdomeson* have not yet been detected in this country, but a closer search in our carboniferous deposits will, I feel convinced, bring them to light. In Great Britain the genus is represented by two species, *R. gracile*, Phill., the type, and *R. rhombiferum*, Phill., both of which I have carefully examined. The surface of both species, and especially that of the first, resembles fig. 7*d*, Pl. I, and it is only in vertical and transverse sections that the essential characters of the genus are made manifest. On the same

* Fourth Report of the Committee of the British Association, consisting of Dr. H. C. Sorby and Mr. G. R. Vine, appointed for the purpose of reporting on Fossil Polyzoa. Drawn up by Mr. Vine, Secretary, 1883.

plate such sections, prepared from authentic examples of *R. gracile*, are represented by figures 8 and 8*a*. Compared with *Rhombopora*, we find that *Rhabdomeson* differs from species of that genus in only a single character to which generic importance is attributable. This is found in the central tubular axis, to which the proximal ends of the zoœcia are attached, and from which they radiate in all directions. In *Rhombopora* no such axis exists, and the zoœcia radiate in all directions from an imaginary axis, the same as they do in all of the ramose *Monticuliporidæ*. While sections of the two genera are therefore readily distinguished, it is, on the other hand, not nearly so easy to separate them by their superficial characters. Indeed, examples of *Rhombopora persimilis*, n. sp. from the Kaskaskia group of Kentucky and Illinois, resemble specimens of *Rhabdomeson gracile* so closely in growth, zoœcial apertures, and distribution of spines, that it requires no little amount of patience to distinguish them successfully.

The family *Rhabdomesontidæ* is an unquestionable member of the Trepostomata, and finds its nearest allies in the section of the *Monticuliporidæ* typified by *Batostomella*, Ulrich. That genus, as well as all other members of that family, differs considerably in the structure of the peripheral or "mature" portion of the zoœcia. While the evidence on the point is not positive, it is still not unreasonable to believe, that in at least some of the *Rhabdomesontidæ* the zoœcial cavities communicated with the spiniform tubuli, and thus with each other, by means of a large number of very minute canals. A central tube, such as marks *Rhabdomeson*, occurs in *Anisotrypa*, and at least in two other Palæozoic genera of Bryozoa, of widely different affinities, the one (*Cœloclema*, Ulrich) belonging to the *Ceramporidæ*, and the other (*Cheilotrypa*, n. gen.) to the *Fistuliporidæ*. In *Rhabdomeson* it is straight and of nearly equal diameter throughout, while in the other genera it is irregularly constricted and expanded. This difference is doubtless mostly due to the facts that in *Rhabdomeson* the zoarium is much more slender, and the cell development, and consequently the general growth of the branches, is more regular than it is in either *Anisotrypa*, *Cœloclema* or *Cheilotrypa*.

Mr. F. B. Meek, the author of *Rhombopora*, regarded the genus as belonging to the Polypi. Against this view I will simply say, that if *Rhombopora* is a coral, then we have no Bryozoa in American Palæozoic rocks.

RHOMBOPORA, Meek, 1871.

(Pal. Eastern Nebraska.)

Zoaria ramose, branches slender. Zoœcia tubular, radiating in all directions from an imaginary axis. Walls abruptly thickened in the "matured" region, where the diameter of the visceral cavity is also more or less constricted. Zoœcial apertures circular or oval, placed at the bottom of more or less obviously impressed, sloping, rhomboidal to hexagonal "vestibules." Ridges separating vestibules spiniferous. Spines hollow, often of two kinds, large and small, the latter most numerous, and surrounding the apertures in a single or double series, while the larger spines are usually developed only at the upper extremity of the cell. Diaphragms generally absent, always few. Zoœcial apertures frequently closed by centrally perforated opercula.

Type: *R. lepidodendroidea*, Meek. Upper Coal Measures.

Several species of this genus show more or less clearly that the inner layers of the cell walls are perforated by a large number of minute foramina or canals, which appear to have communicated with the hollow vertical spines. I have also noticed them in a transverse section of *Rhabdomeson gracile* (Fig. 8, Pl. I.), and it is possible that such foramina are characteristic of the family.

Through *R. crassa*, n. sp., and *Ceripora interporosa*, Phill., which, if my specimens have been correctly identified,* must be referred to this genus, we can trace a resemblance to carboniferous species of *Batostomella* (*e. g. B. tumida*, Phill., sp.). In both of those species the hollow spines are represented in the weathered condition of the zoarium by an equal number of minute pits. This peculiarity can not be explained satisfactorily, except by supposing that these structures in the two species under consideration possessed a larger cavity than was usual, which, as growth proceeded, was filled by a secondary deposit. In tangential sections they present nothing different from the usual appearance of spiniform tubuli. In all other respects the two species agree closely with typical species of *Rhombopora*, and consequently differ from species of *Batostomella*.

My observations show that in the Palæozoic rocks of America the genus is represented as follows: in the Niagara group by at least

* My specimens were received from Mr. G. R. Vine, who, in his last report to the British Association on Fossil Polyzoa, places the species with *Heteropora*. I must differ with him on this point, as I can not find that the species in question is more than only remotely related to species of *Heteropora*.

one species; in the Lower Helderberg group by two; in the Devonian by two or more; in the Lower Carboniferous formations by at least six; and in the Coal Measures by three. Of these have been described only the two Lower Helderberg species by Hall (as species of *Trematopora*), and the type of the genus by Meek. Following will be found descriptions of five Lower Carboniferous species and one Coal Measure species.

RHOMBOPORA LEPIDODENDROIDEA, Meek. (Pl. I., figs. 1, 1*a* and 1*b*.)

Rhombopora lepidodendroides, Meek. Pal. Eastern Nebraska, p. 141, Plate VII., figs. 2, *a*, *b*, *c*, *d*, *e*, *f*.

This species forms ramose slender, cylindrical, remotely bifurcating zoaria, the average diameter of which is about .07 inch, the largest fragment seen having a diameter of .12 inch. Distance between bifurcations varying from .30 to .90 of an inch. Zoœcia arranged very regularly in quincunx, forming vertical, transverse and intersecting spiral series around the branch, with broadly elliptic apertures, placed at the bottom of distinctly impressed and expanding vestibules of rhombic form, the margins of which are occupied by a single, occasionally a double, series of small spiniform tubuli, and generally at each angle by one of much larger size. In the usual state of preservation, the small spines are not apparent. Measuring in the direction of the oblique rows, seven or eight cells occupy the space of 0.1 inch.

In tangential sections (Pl. I., fig. 1) the cells are elliptical, about their own diameter distant from each other, with apparently amalgamated walls. The line of contact between adjoining cells is marked usually by a single row of minute dark spots, which, under favorable circumstances, enclose another very small lucid spot, proving them to have been hollow, while at the ends of the cells, almost invariably, occurs a much larger thick-walled tubulum. These represent the two sizes of granules or spines observed at the surface.

Longitudinal sections (Pl. I., fig. 1*a*) show that in the axial or "immature" region the tubes have thin walls, that they rapidly attain their full size, and slope outward almost immediately after being developed. Near the surface the direction changes until it is nearly at a right angle with the plane of the surface. In the peripheral region their walls are abruptly thickened, and composed of thin superimposed layers, which slope dowward on each side to the visceral cavity, and indicate the form of the vestibules at previous stages of growth. Beside a larger number of slender, apparently interrupted, dark lines, representing the small spiniform tubuli, a section will show a limited number of the

large spiniform tubuli, the cavities of which, in several instances, are crossed by faint transverse lines, placed on a level with the successive layers of sclerenchyma before spoken of. When the section passes through the centre of the zoarium, the inferior wall of each tube, just at the base of the "matured" portion, is seen to be angular, and rarely produced into an incomplete diaphragm. As such a section is not readily made, I have figured a portion of one passing a little to one side of the centre. In such sections the angularity of the inferior wall is not noticeable, being obscured by a portion of an adjoining tube. Diaphragms are usually absent, and I have never noticed more than a single one in any tube.

In the axial region of a transverse section (Pl. I., fig. 1*b*) the cells are polygonal, thin-walled, and increase slightly in diameter outwardly. In the peripheral region their diameter is somewhat lessened, and their walls much thickened, and traversed by the spiniform tubuli.

Formation and locality: This is a common species in the Upper Coal Measures of the Western States. The best localities known to me are at Kansas City, Mo., Nebraska City, and Wyoming, in Nebraska.

Rhombopora crassa, n. sp. (Pl. I., figs. 2, 2*a*, 2*b*.)

Zoarium ramose, branches comparatively robust, sub-cylindrical, from 0.10 to 0.18 inch in diameter, dividing dichotomously at intervals of 0.75 of an inch, more or less. Zoœcia with broadly elliptical apertures, surrounded by a shallow vestibule, and arranged in rather regular obliquely intersecting series, in which six or seven may be counted in the space of 0.1 inch. Margins of vestibules occupied by from one to three rows of distinct, subequal granules or spines, which, in the worn state, are represented by an equal number of small pits. Cell walls varying somewhat in thickness with age.

Tangential sections (Pl. 1, fig. 2) show that the zoœcial apertures are elliptical, and surrounded, first, by a thin dark ring, in which a large number of excessively minute spots or foramina may be detected; then by a lighter, apparently structureless, band of sclerenchyma, and lastly, by eighteen or twenty rather large and closely arranged spiniform tubuli. The last usually occur in single or double series between the zoœcia, but at irregular intervals they are more numerous, and form small "maculæ" (see figure).

In vertical sections (Pl. I., fig. 2*b*) the tubes in the axial region of

the zoarium have, as usual, thin walls; they are never vertical, but proceed obliquely toward the surface, almost immediately after development. In the "mature" or peripheral region, which is larger than in any other species of the genus known to me, their walls are much thickened, and the successive stages of growth are marked by bands of sclerenchyma parallel with the surface. The spiniform tubuli are peculiar, and, under a high power, appear to consist of a large number of excessively minute dark spots, which are irregularlv arranged in vertical series. If I am right in my belief, then these spots represent the other ends of small canals, by means of which the spiniform tubuli were brought into communication with the visceral cavities of the zoœcia. In the wall substance immediately surrounding the latter they are very distinct, and certainly hollow. Diaphragms very few, or absent.

Near the center of transverse sections (Pl. 1, fig. 2*a*) the tubes are small; in the second cycle they have nearly attained their full size while some of the third cycle may be traced to their apertures at the surface of the branch. In the peripheral region the tubes are cut longitudinally, and present characters already noted in describing this region of a vertical section.

This species is perhaps more nearly related to *R. lepidodendroidea*, Meek, than to any other species of the genus. They differ, conspicuously, however, in several respects. Well-preserved examples of the two species are readily distinguished from each other by their surface peculiarities. The vestibules of the zoœcia in Meek's species are more distinct, and rhomboidal, which is not the case in *R. crassa*, while the cells of the latter are larger and not so regularly arranged as those of the type species. The single large spiniform tubulum, which is apparently always developed at the ends of the cells in *R. lepidodendroidea*, is wanting in *R crassa*, while the usual spiniform tubuli of the latter are larger than those of Meek's species. Further, where examples of *R. lepidodendroidea* are worn, the interspaces are smooth, and the spiniform tubuli are not represented by small pits, as is certainly the case in *R. crassa*. As will be seen by comparing the figures of the two species given on Pl. I., their sections present equally important differences.

Formation and locality: In the Upper Coal Measure deposits at Kansas City, Mo., where it is associated with, but less common than *R. lepidodendroidea.*

Rhombopora persimilis, n. sp. (Pl. I., figs. 7, 7*a*, 7*b*, 7*c*, 7*d*.)

Zoarium ramose, branches cylindrical, rigid, very slender, about .035 inch in diameter. The mode of branching is characteristic. The stems do not divide dichotomously, but the branches are thrown off at nearly a right angle from a main stem. The intervals between these branches vary greatly, some specimens remaining undivided for a distance of nearly three fourths of an inch. Zoœcia arranged very regularly in vertical, transverse, and more particularly in diagonally intersecting series; apertures elliptical, occupying the bottom of distinct, sloping, rhombic or acutely elliptical vestibules, the margins of which are ornamented by a single row of small spiniform tubuli. A larger spine, though often missing, is usually placed between the ends of the cells. The zoœcial apertures are sometimes covered with centrally perforated opercula. Measuring in the direction of the vertical series, about five and one half cells occupy the space of .1 inch; in the transverse rows, twelve, and along the oblique series, ten may be counted in the same space. The number of vertical series around a stem varies from twelve to fifteen.

Tangential sections (Pl. I., fig. 7*a*) are, on account of the small size of the zoarium, difficult to prepare, but when satisfactory they present the usual characters belonging to species of this genus. The section figured shows all the peculiarities noticed.

In longitudinal section (Pl. I., 7*c*) three or four tubes in the axial region are nearly vertical and extremely long, and may be called parent tubes, as the greater number of cells are developed from these by gemmation. In the peripheral region, which is comparatively narrow, the walls are abruptly thickened, and the tube cavities constricted by the angular projection of the inferior wall. The spiniform tubuli are easily distinguished. Diaphragms have not been detected, but at the bottom of the vestibule the thin opercular covering of the cell apertures may often be detected.

Transverse sections (Pl. I., fig. 7*b*) show that the axial region is occupied by numerous thin-walled and unequal polygonal cells.

In some respects this species is allied to *R. lepidodendroidea*, but the two are not likely to be confounded. The cells and branches of that species are larger, and the mode of growth is different, while the direction of the tubes in the axial region of the zoarium is also quite different. It is almost impossible to separate fragments of this species from those of *Rhabdomeson gracile*, Phill., by their

external characters. Sections of the two forms, however, show conclusively that they are widely different, as will be seen by comparing figs. 7*b* and 7*c* with 8 and 8*a*, on Plate I.

Formation and locality: A characteristic fossil of the Kaskaskia Group of the Lower Carboniferous rocks. My types are from Chester, Ill., and Tateville, Ky.

RHOMBOPORA PULCHELLA, n. sp. (Pl. I., figs. 6, 6*a*.)

This species resembles the preceding so much that a detailed description is scarcely necessary, and I will only point out the principal external points of difference between them. Its branches, while they are of the same size as those of *R. persimilis*, differ in their mode of branching, as they divide dichotomously. The cell apertures are, if at all different in size, slightly larger and more acute above. The vestibules are narrower, and extend considerably beyond the front end of the aperture, where they enclose a rounded node or spine, which is situated just in front of the aperture. The margins of the vestibules are not sharp as those of that species, and carry two, sometimes three, rows of minute granules. At irregular intervals one of the zoœcia is missing, the vacant spot in that case being occupied by a small aggregation of spines or granules.

The peculiarities are all brought out in fig. 6*a*, on Plate I., representing an enlargement of the surface of a branch to 18 diameters.

Formation and locality: Rather rare in the Kaskaskia Group of the Lower Carboniferous, at Tateville, Ky.

RHOMBOPORA ARMATA, n. sp. (Pl. I., figs. 5, 5*a*.)

Zoarium ramose, branching very much like *R. persimilis*. Zoœcia with deep but narrow vestibules, and comparatively large sub-circular apertures, arranged regularly in a quincuncial manner, forming therefore vertical; transverse and obliquely intersecting series. Between the ends of the cells are found, almost invariably, two large and remarkably prominent spines, which, except, in perfectly cleaned examples, thoroughly obscure the zoœcial apertures. Under the common pocket lens these spines seem to b more especially arranged in transverse series, but by viewing them from different points they also arrange themselves in oblique and vertical series. Measuring transversely, six cells occupy the space of 0.05 of an inch, and eleven to thirteen encircle the branch; vertically, seven occur in 0.1 inch, and obliquely, about twelve occupy the same space.

The remarkable prominence of the spines of this species will distinguish it from all other species of the genus known. When worn it resembles *R. persimilis*, with which it is found associated. Its subcircular and larger cell apertures, and thinner interspaces, will, in that case, serve to separate them.

Formation and locality: Not common in the Kaskaskia Group, at Tateville, Ky.

RHOMBOPORA WORTHENI, n. sp. (Pl. I., figs. 4, 4*a*, 4*b*.)

Zoarium doubtlessly ramose, although all the examples noticed are unbranched, and four of them nearly one inch in length. Stems cylindrical or nearly so, from .05 to .08 of an inch in diameter, and rigid. Zoœcia with elongated apertures, narrow vestibule, and comparatively thin interspaces. Typically their form is oblong quadrate, and their arrangement (as shown in fig. 4*b*, Plate I.) very regular, in vertical and diagonally intersecting lines. Measuring diagonally, eleven cells occupy 0.1 inch, while in the vertical series seven and one half of them occupy the same space. On portions of the surface of other specimens their form is rhomboidal or hexagonal, and the ends of the cells are not truncated, but are angular and wedged in between two alternating cells. A small rounded node or spine, although almost invariably situated between the ends of the cells, is readily overlooked. On account of the extreme brevity of the peripheral or "immature" region, I have not been able to prepare successful tangential sections.

Longitudinal sections (Pl. I., fig. 4*a*) are very characteristic. They show about four extremely long, thin-walled vertical tubes, from the outer ones of which the majority of the tubes opening upon the surface are developed by gemmation. In the peripheral or "matured" region of the zoarium, the walls of the tubes have a peculiar form. The basal portion of the "matured" cell is marked by a spur or incomplete diaphragm, that projects at a right angle from the inferior wall into the visceral cavity of the tube. Above this the walls are somewhat thickened and recurved. Diaphragms, other than the incomplete ones described, have not been observed.

In transverse sections the cells in the central region are usually rhomboidal, nearer the periphery they become hexagonal or polygonal.

While *R. wortheni* preserves the essential characters of the genus, its internal peculiarities nevertheless separate it widely from all other species known.

Named in honor of Prof. A. H. Worthen, the accomplished geologist of the State of Illinois.

Formation and locality: Lower Carboniferous sandy shales, near Somerset, Ky. The exact height of the strata is undetermined, but they belong either to the St. Louis Group or the lower portion of the Kaskaskia beds.

RHOMBOPORA ELEGANTULA, n. sp (Pl. I., figs. 3, 3*a*, 3*b*.)

Zoarium branching at remote intervals, and consisting of cylindrical stems 0.1 inch, or a little less, in diameter. Zoœcia rhomboidal or hexagonal, with small ellipitical apertures placed at the bottom of an expanded and distinct vestibule, which is margined by a faintly granular, thin but distinctly elevated, divisional ridge. At intervals a few cells of slightly larger size than the average may be observed, which disarrange their otherwise regular arrangement in both vertical and obliquely intersecting lines. In a vertical direction four or five cells occupy the space of 0.1 inch; in an oblique direction, six cells occupy an equal space.

Tangential sections (Pl. I., fig. 3*a*) show that the line of demarkation between adjoining cells is usually marked by a single series of very minute spiniform tubuli, that the cells walls are extremely thick, and the cell cavities more or less unequal in size.

In longitudinal sections (Pl. I., fig. 3*b*) the zoarium is conspicuously divided into the two peripheral and axial regions. In the latter the tubes are thin-walled, though not excessively so, and proceed towards the surface with a gentle curve. As they reach, on each side, the peripheral regions, they bend abruptly outward. Here their walls become excessively thickened, and it is for this reason that the true form of the "matured" cell is not often shown, as the section usually affords only a view of the walls. The figure referred to above presents two tubes showing their true form. It seems quite certain that an occasional diaphragm crosses the tubes in the axial region, but as they are not sharply defined in my sections, and might not really be such structures, I have not allowed them to appear in the figure.

The surface appearance of the cells of this species reminds one considerably of *Anisotrypa symmetrica*, described by me in the last part of this memoir. By consulting fig. 5*a*, on Plate XIII., a fair idea may also be obtained of the superficial characters of the cells of *R. elegantula*.

Formation and locality: Lower Carboniferous shales, at King's Mountain, on the Cin. South. R. R. The strata are probably part of the Keokuk Group.

CYSTODICTYONIDÆ, n. fam.

Zoaria consisting of two or more leaves or layers of cells, grown together back to back by the junction of their basal membranes. Zoœcia tubular, with a small crescentic lip on one side of the aperture, the ends of which project into the visceral cavity of the tubes, and gradually form vertical ridges. Interstitial spaces occupied by vesicular tissue, which, in the matured stage, is almost obliterated by a secondary deposit of sclerenchyma, apparently perforated by minute, vertical, communicating canals. Margins of zoaria sharp or rounded, non-poriferous.

Type: *Cystodictya*, Ulrich.

After a careful study of the genera possessing the above characters, I come to the conclusion that I am not only justified in founding a new family for their reception, but I am obliged to do so. As now known, the family will include *Cystodictya*, Ulrich, *Coscinium*, Keyserling, *Glyptopora*, n. gen. (*Coscinium*, Prout, not Keyserling), *Prismopora*, Hall, and *Evactinopora*, Meek and Worthen. Beside these *Rhinopora*, Hall, *Tæniopora*, Nicholson, and *Scalaripora*, Hall, will, most probably, also be found to belong here, but until their internal structure has been more carefully studied, their systematic position must remain doubtful. In my scheme of classification I placed *Cystodictya* in the fam. *Stictoporidæ.* This disposition of the genus I now regard as erroneous, and much more extended researches, now being carried on, tend to show that the limits of that family, as originally defined by me, are not positive in every case. If my investigations have sufficiently progressed, I propose to revise the *Stictoporidæ*, and perhaps other families, in the next number, when it is also expected that this memoir will be brought to a close. In the meantime it is certain that the characters of *Cystodictya*, if we lay the greater stress upon cell structure, relate the genus more closely with the *Fistuliporidæ* than with the typical *Stictoporidæ.* In forming my scheme of classification, I at first sought, as much as possible, to found my divisions throughout upon certain characters. Although this desire was not carried out, it nevertheless, I might say unconsciously, had an effect upon the result, and the erroneous references

now known are generally due to its influence. Practice, however, proves that such a classification can not even be approximately natural when applied to Palæozoic Bryozoa. It seems that in those early times their characters had not yet attained the stability that marks the more recent forms, and makes their classification, comparatively, an easy task. Among the Palæozoic Bryozoa almost any characters may, for a time, be endowed with great importance, and its value can only be determined by ascertaining its degree of persistency, and comparing it with that of the other characters. Thus by obtaining the average of importance, if the expression be allowed, a very nearly natural classification is the result. In the proposed fam. *Cystodictyonidæ* we have a combination of characters not occurring in any other group, while, on the other hand, not one of these can be said to pertain to this group alone, nor to be especially distinctive. The systematic position of the family appears to be between the *Stictoporidæ* and the *Fistuliporidæ*. From the former it differs in having the interstitial spaces occupied by vesicular tissue, the cell apertures provided on one side with a lip, and the consequent two vertical ridges which project into the visceral cavity of the tubes. From the *Fistuliporidæ* the new family differs mainly in possessing two or more leaved zoaria, the margins of which are non-poriferous, and usually sharp.

CYSTODICTYA, Ulrich, 1882. (*Ante* vol. v., p. 152 *et* 170.)

Arcanopora, Vine. Fourth Rep. to Brit. Ass. on Fossil Polyzoa, 1883.

Zoaria composed of two layers of cells grown together back to back, assuming the form of dichotomously divided, compressed branches, with an acutely elliptical transverse section, and sub-parallel, sharp, non-poriferous margins. Zoœcia tubular, prostrate at first, then abruptly assuming an erect position. Superficially they are arranged in regular longitudinal and diagonally intersecting series, with sub-circular or sub-pyriform apertures, on the outer side of which the margin is elevated to form a small lip. The ends of this lip project slightly into the cell cavity, gradually forming, as growth proceeds, two slender ridges, the lower one being developed a little earlier than the upper (see Pl. II., figs. 3, 4*c*, and 5). Zoœcial apertures closed by centrally perforated opercula. Inter-apertural spaces smooth or finely striated. Tangential sections, passing through the "immature" region of the zoarium, show that the zoœcia are ranged in longitudinal series between vertical plates, to one of which they are laterally attached, while the intervening spaces are occupied by irregularly

shaped smaller cells. Nearer the surface the latter are no longer to be determined, being here filled by a secondary deposit. Near the united median laminæ in longitudinal sections their vesicular character is very distinct. Diaphragms apparently wanting.

Type: *C. occelata*, Ulrich, Vol. v.. Pl. VIII., figs. 3, 3*a*; and Vol. vii., Pl. II., figs. 3, 3*a*.

The species of this genus, as now established, are interesting on account of their external resemblance to *Stictopora*, Hall. One of the species now referred to *Cystodictya* (*Stictopora gilberti*, Meek) was allowed to remain in that genus, even after I had prepared a tangential section. It is true my material was poor, the zoarium having been replaced by pyrites of iron, which in a great measure destroyed, what now prove to be, the most important characters. Besides the section passed through the zoarium just below the surface, where the vesicular interstitial tissue can not be determined under even the most favorable circumstances. Much better material, since obtained, from which excellent sections have been prepared, now enable me to rectify the error, and place the species where it really belongs. The small lip, which, as is the case in all the species of the genus, consists of a crescentic elevation on the outer margin of the cell aperture, is very distinctly preserved. The two ends of the lip project more than usual into the zoœcial cavity. All of the internal characters observed are well shown on Pl. II., by figs. 5, 5*a* and 5*b*.

Mr. G. R. Vine has proposed the generic name *Arcanopora* for Phillips' *Flustra* (?) *parallela*. I have identified this species in the Keokuk Group of Kentucky. The American specimens, though a little larger, agree closely in other respects with authentic British examples. The species is, however, a true *Cystodictya*, and in consequence *Arcanopora* can not stand.* *Cystodictya parallela*, as it should now

* In the same report Mr. Vine also proposes the family *Arcanoporidæ*, of which he makes his *Ptilodictya lonsdalei* the type. This species he also makes the type of *Ptilodictya*, although the fact is unquestionable that Lonsdale founded the genus upon Goldfuss' *Flustra lanceolata*. But such a substitution of types is entirely out of the question, and not to be considered for a moment. Furthermore, his fam. *Arcanoporidæ*, in its type, is an exact synonym for Zittel's *Ptilodictyonidæ*, since *P. lonsdalei* is a *Ptilodictya*, and that genus is the type of Zittell's family. This is a needless duplication of names, and with my work on that family before him, is really inexcusable. I used and defined the genus *Ptliodictya* as typified by the *P. lanceolata*, Goldf. sp., which is also Lonsdale's type. Mr. Vine charges that the characters which I give as a diagnosis are not those of Lonsdale. To this I answer, that the characters he ascribes to the genus are no more Lonsdale's than are mine, and because that author misunderstood the characters of his genus is certainly no reason for me to do likewise. Mr. Vine's conclusions on British Bryozoa, in so far as they have reference to palæozoic forms, differ in most cases from my own. Their faultiness is often so mani-

be called, is marked by its slender, remotely bifurcated zoarium. The branches have a width of from .04 to .07 inch, and a thickness of .02 to .03 inch. The surfaces are more or less convex, and longitudinally furrowed like *C. lineata.*, n. sp., and in these furrows the zoœcial apertures, which are directed obliquely inward, are situated. The crescentic lip is well developed, and placed at the lower and outer margin of the aperture. On account of the prominence of the lip, the zoœcial apertures appear to be decidedly oblique. The margins of the zoarium are more or less acute, non-poriferous and finely striated. Each side of a branch carries four, sometimes five, longitudinal rows of cells, in which about nine occur in the space of .2 inch.

Cystodictya lineata, n. sp. (Pl. II., figs. 4, 4*a*, 4*b* and 4*c*).

Zoarium dividing dichotomously at intervals of 0.5 inch to 1.0 inch; width of branches from 0.12 to 0.20 inch; greatest thickness, about 0.04 inch; non-poriferous margin narrow, smooth or finely striated; edges acute. Surface of each face more or less elevated, rounded, and often faintly striated, longitu dinal ridges, between which the cell apertures are arranged. Under a magnifier of low power these are elliptical or subcircular, but under a higher power are seen to be depressed-pyriform, the margin of the aperture being inflected by the ends of the elevated crescentic lip. In every instance the lip is placed on the outer lateral margin of the cell orifice, so that on each side of the longitudinal center of the branch the zoœcial apertures appear to be directed toward each other. Toward the sharp borders the vertical ridges become less prominent, and here the cells are, generally, also larger, and often occupy the oblique summits of small papillæ. In a longitudinal direction usually three, rarely four, cells occupy the space of 0.1 inch; in the same space diagonally there are

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fest that I am forced to the conviction that he did not give to these intricate forms the study they demand. For instance, it is very evident that he did not understand the characters of *Cystodictya parallela* (*Arcanopora parallela*, Vine), or he would not have placed it in such close proximity to *Ptilodictya lonsdalei.* These two species resemble each other only in the possession of zoœcia, and a double-leaved zoarium. In other respects they are no more than only remotely related. Another instance is found where he proposes the fam. *Polyporidæ.* He is a shrewd naturalist, indeed, that succeeds in separating *Polypora* from *Fenestella*, to such an extent. American strata contain so many intermediate forms that I find no little difficulty in drawing the generic line. On the whole, I believe that Mr. Vine's knowledge of Palæozoic Bryozoa is not unlimited, although the unsuspecting student might, from his style, be led to believe that he had, at least, aided in the creation of the Bryozoa. I confess that I have not been so impressed, and, if I may be so bold, I should suggest that Mr. Vine extend his researches to other than British material. The almost endless number and variety of American forms are to be recommended.

four, and where the branch has a width of 0.18 inch, there are nine vertical series.

The internal characters are, on the whole, very much like those of *C. occelata*, the type of the genus, and do not demand detailed description. In tangential sections (Pl. II., fig. 4*c*), just below the surface, the inter-zoœcial spaces are finely lined. At a deeper level the vesicular tissue is brought to view. The vesicles, like everything else pertaining to the species, are arranged in longitudinal series.

This species is readily distinguished from both *C. occelata*, Ulrich, and *C. carbonaria*, Meek, by the more widely separated zoœcia, and distinct longitudinal ridges and furrows, which mark the surface. From *C. parallela*, Phill., it differs in having from eight to ten rows of cells; that species has only four or five. In all other respects they are closely allied.

Formation and locality: This is a common species in the St. Louis and Keokuk groups of the Lower Carboniferous. My types are from the Keokuk beds at King's Mountain tunnel, on the Cincinnati Southern Railroad.

Coscinium, Keyserling, 1846.

This genus possesses all the essential characters of the *Cystodictyonidæ*, and differs from *Cystodictya*, somewhat in cell-structure, but mainly in the form of the zoarium. *Coscinium cyclops*, Keyserling, the type of the genus, also occurs in America, and is not an uncommon fossil in the Upper Helderberg limestone near Louisville, Ky. A tangential section of this species is represented by fig. 6, on Plate II. Such sections show that the inter-zoœcial spaces are occupied by smaller cells, whose vesicular form is demonstrated by vertical sections. Just below the surface the vesicular tissue is not apparent, here being filled by a secondary deposit, that is perforated by a great number of minute vertical canals. As is clearly shown in some sections, these canals consist of two kinds, large and small, the latter most numerous, but often destroyed during the process of fossilization. (This, unfortunately, was the case in the section figured, which, at the time I prepared the plate, was the best I had.) The cells have all the characteristic features of the family. The generic characters of *Coscinium* are briefly as follows:

Zoaria forming thin flattened expansions, composed of branches which inosculate at short intervals, till there is produced a broad frond

perforated at rythmical intervals by circular or elliptical fenestrules. Both sides of the zoaria are celluliferous, and the fronds consist of two equal layers of cells, that have grown together back to back, but in such a manner, that each layer preserves its own concentrically striated epithecal membrane. A smooth or finely striated non-celluliferous border surrounds the fenestræ. Zoœcia with sub-circular or elliptical apertures, that are slightly oblique, and provided with the usual small lip on the outer margin. Inter-zoœcial spaces occupied by unequal vesicular cells, which, near the surface, are filled by a secondary deposit, vertically perforated by numerous minute communicating canals. Diaphragms not observed.

Type: *C. cyclops*, Keyserling. The genus, so far as known, occurs only in Devonia deposits.

Hall's genus *Clathropora* is usually regarded as synonymous with *Coscinium*, but that is an error. While the form of the zoarium in the two genera is almost identical, their cell structure, and internal characters generally, are totally unlike. The minute characters of *Clathropora frondosa*, Hall, which must be considered as the type of the genus, prove *Clathropora* to be an unquestionable member of the *Ptilodictyonidæ*, since the cell structure of that species is, in almost every particular, precisely like that of the most typical species of *Ptilodictya.* Some authors would perhaps on this account unite *Clathropora* with *Ptilodictya*, but I believe that this is a case wherein the difference in the mode of growth should be regarded as of generic importance.

Prout has described a number of Lower Carboniferous Bryozoa, as species of *Coscinium.* I can not see that any of these really belong to that genus, although the most of them belong to the *Cystodictyonidæ.* For their reception I propose the new generic name of *Glyptopora.*

Glyptopora, n. gen.

Zoaria forming thin, leaf-like expansions, composed of two sub-equal layers of cells, adhering to each other back to back. Both surfaces celluliferous, with an elevated, sharp midrib, or ridge, which may simply divide dichotomously at varying intervals, or inosculate more or less frequently, so as to leave irregular cup-shaped depressions. The sharp margin of this ridge is non-poriferous, and may be either straight or serrated. Distributed with some regularity over the

depressed portions of the two surfaces are sharply defined, more or less elongated, depressed "maculæ" or furrows, which may bifurcate once or twice. The remaining portions of the surface are uniformly occupied by the zoœcial apertures, which, as usual, are provided with a small crescentic lip. Inter-zoœcial spaces occupied by vesicular cells, which are filled, and quite obliterated, in the "matured" regions, by a secondary deposit.

Type: *Coscinium plumosum*, Prout. St. Louis Group of the Lower Carboniferous.

Beside the type species, *C. elegans*, *C. wortheni*, *C. keyserlingi*, and *C. saganella*, all described by Prout, must be referred to this genus. I have not seen the other species referred to *Coscinium* by Dr. Prout, but judging from the figures in the Pal. Ill., Vol. ii., Pl. XXII., I am inclined to think that his *C. michelinia* belongs here. He says of this species that it is incrusting, but I regard that as very improbable. If it is a double-leaved species then it is a *Glyptopora*, and closely allied to, if not identical with, the type species. *C. asteria* and *C. escharense* are very likely species of *Lichenalia*.

The systematic position of *Glyptopora* is intermediate between *Coscinium*, Keyserling, and *Prismopora*, Hall, but nearer the latter.

Prismopora, Hall. 1881.

(Bryozoans of the Up. Helder. Group.)

Zoaria consisting of triangular branches, divided dichotomously (Hall says also trichotomously) at more or less remote intervals: sides equal or unequal, concave, each celluliferous. In transverse sections the cells are seen to arise from internal epithecal laminæ, which radiate from the center to each angle, and divide the branch into three sub-equal triangular portions. Zoœcia regularly or irregularly arranged, with subelliptical, oblique or distinctly lipped apertures, sometimes occuping the summits of small papillæ. Margin of each face non-celluliferous; edges straight or serrated. Interstitial spaces smooth, and apparently solid at the surface; internally, sections show them to be occupied by more or less obliterated vesicular cells. Diaphragms few, developed on the same level in adjacent tubes.

Type: *P. triquetra*, Hall. Upper Helderberg Group.

This genus is represented in American palæozoic rocks by at least five species, and ranges in time from the Upper Helderberg Group to

the Upper Coal Measures. From the Devonian the type species and *P. paucirama* are described by Hall. A third is described by Rominger from the Keokuk Group, under the name of *Fistulipora trifolia.* The fourth is a characteristic fossil of the Kaskaskia Group, and is next described. While the fifth is known under the name of *Ptilodictya triangulata*, and was described from Coal Measure deposits by White.

PRISMOPORA SERRULATA, n. sp. (Pl. II., figs. 2, 2*a*, 2*b*, 2*c*, 2*d*, 2*e*, 2*f*.)

Zoarium consisting of remotely bifurcating triangular branches; the sides are sub-equal and slightly concave; the edges sharp, wavy or serrated. Zoœcia with small elliptical apertures, separated from each other about twice their diameter; arranged in four or five rather irregular longitudinal rows in the central portion of each face; and in groups of from eight to fifteen cells, often a little larger than the average, and extending to the extremities of the marginal serratures. Between these groups there is a crescentic, smooth, non-celluliferous space. About six cells may be counted in the length of 0.1 inch. In 0.5 inch, from four to six marginal serrations occur.

In tangential sections (Pl. II., fig. 2*c*) the zoœcia are irregularly elliptical in form, with one or two slight inflections of their thin ring-like walls. In the lower levels the vesicular interstitial cells are very distinct; in size they are very unequal, and in form irregular, while they surround the true zoœcia in double or triple series. Just below the surface they are indistinct, and the interstitial spaces appear to be occupied by a dense deposit of sclerenchyma, in the substance of which numerous minute dark dots may be observed, that doubtlessly represent communicating foramina.

Vertical sections (Pl. II., fig. 2*e*) show that the tubes are at first prostrate, then abruptly bent outward; in this portion two or three diaphragms cross each tube. The interstitial spaces are occupied by a closely woven vesicular tissue, the meshes of which become obsolete near the surface.

In transverse sections (Pl. II., fig. 2*e*) the tripartite character of the zoarium is clearly shown.

This species is readily distinguished from all other species of the genus known to me by its wavy or serrated margins.

Formation and locality: Not uncommon in the Kaskaskia Group of the Lower Carboniferous at many localities in Kentucky and Illinois. My types are from Tateville and Grayson Springs, Ky.

Evactinopora, Meek and Worthen. 1865.

(Proc. Acad. Nat. Sci. Philad. p. 165.)

Zoaria free, consisting of four or more vertical leaves, which radiate from an imaginary vertical axis, so as to present in a transverse section, a star-shaped, or cruciform outline. Rays thin, celluliferous on both faces, and free above; united, thick and non-poriferous below; thickest and most dense on the under and outer edges; each divided in the middle by the thin, concentrically striated, epithecæ laminæ, to which the lower ends of the tubes are attached. Zoœcia with sub-circular, oblique apertures, the lower margin being elevated. Interstitial spaces occupied by vesicular cells, more or less densely filled by a laminar deposit of sclerenchyma. This deposit is traversed by a vast number of minute, interrupted foramina or canals, and, as growth proceeded was gradually drawn over the cell apertures of the lower and older portions of the zoarium.

Type : *E. radiata*, M. and W. Burlington and Keokuk groups.

One of the most important and peculiar features of this genus is found in the comparatively large, non-poriferous areas, less than half of the zoarium of *E. radiata* being celluliferous. I have been fortunate in finding a number of excellent examples of this species, and on Plate II. I have illustrated the characters not heretofore published. The entire zoarium is elliptical in outline. The rays at a point about one half their length from the rounded base, become free, are sharp-edged, non-poriferous on each border, and gradually taper upward to a point. These characters are shown in figs. 1 and 1*a*. The rays vary in number from six to eight. Of twenty specimens found, four have six; five, eight; and eleven, seven rays.*

In the cellular structure, as is shown by figs. 1*b* and 1*c*, the genus is almost exactly like *Coscinium*, Keyserling, to which the genus is therefore closely allied. But the great and very obvious differences in growth, make comparisons between the two genera quite unnecessary.

FISTULIPORIDÆ.

This family differs from all other groups of Palæozoic Bryozoa, excepting the *Cystodictyonidæ*, in the possession of a vesicular intersti-

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* Meek and Worthen, the authors of the species, credit it with eight rays, and regard another specimen with only six rays, as belonging to another species, which they name *sexradiata*. Singularly enough, their figure of the latter shows only five rays. Under the circumstances I must believe that this discrepancy is due to the artist, and if *E. sexradiata* differs in no other respect from *E. radiata*, then the name should be abandoned.

tial tissue; and from that family, in being without any non-poriferous margins or ridges, and the consequent peculiarities of the form or growth of the zoaria, and in having the interstitial vesicles open throughout, or the secondary interstitial deposit, when present, more superficial.

After a careful study of perhaps half of the described species, doubtlessly belonging to this family, I must still confess that I have not been successful in dividing it up into genera thoroughly satisfactory to me. But in the hope that future researches will prove my conclusions to be in the main correct, I propose the following divisions: *Fistulipora*, McCoy, *Lichenalia*, Hall (*Didymopora*, Ulrich), *Eridopora*, Ulrich, and *Cheilotrypa*, n. gen. In my scheme of classification (vol. v., p. 157), I placed *Eridopora*, provisionally, with the *Ceramoporidæ*, as the superficial characters greatly resemble those of species of *Ceramoporella*. But now, while I still regard *Eridopora* as being, in a measure, the connecting link between the *Ceramoporidæ* and *Fistuliporidæ*, I can see that the possession of a vesicular interstitial tissue, proves the affinities of the genus to be nearer the latter. The genus differs from *Fistulipora* in forming only thin and delicate parasitic expansions, in the form of the cells, which are triangular or ovoid, and in the oblique, often imbricating, cell apertures, one margin being much more elevated than the other.

Fistulipora, McCoy. 1849.

(Ann. and Mag. Nat. Hist., 2nd ser., vol. 3.)

Zoaria massive, lamellate, attached to foreign bodies, or free, with a wrinkled epitheca below; less commonly ramose or subramose, branches large, irregular, often hollow; the central cavity large, irregular, and lined with a plicated epithecal covering. Zoœcia with circular or elliptical apertures, surrounded by a more or less distinct peristome; internally with complete straight diaphragms; tube wall thin, the anterior portion often corrugated or flexuous. Interstitial spaces with shallow pits, or smooth, flat or concave; internally occupied by one or more series of vesicular cells.

Type: *F. minor*, McCoy. Carboniferous.

From my investigations I find that the genus is represented in American deposits by at least six species, which range in time from the Niagára group to the Upper Coal Measures. These are distributed as follows: a lamellar species (*F. neglecta*, *Rominger*) in the Niagara

group; a large irregularly branched hollow species (perhaps identical with *F. utricula*, Rom.) in the Upper Helderberg; a large subramose form (*F. crassa*, Rom.) in the Hamilton group; one irregular submassive or lamellate species (*F. prolifica*, n. sp.) from the St. Louis group; one lobate or sub-massive form (*F. excelens*, n. sp) in the Kaskaskia group; and one lamellate or sub-massive species (*F. carbonaria*, n. sp.) from the Upper Coal Measures. In 1866 Rominger published* descriptions of eighteen species, all of which he refered to *Fistulipora.* Unfortunately none of them were illustrated, and as the descriptions are brief, and entirely inadequate according to our modern ideas, I have not been able to identify the majority of them, and therefore can not say whether they really belong to the genus or not. One, the *F. trifolia*, is, as already stated, a species of *Prismopora.* Of *F. neglecta* and *F. crassa* I have examined authentic specimens. These doubtless are correctly classified. Of the remaining fifteen species, while I can not say anything positive of them, several will probably be found to belong to *Lichenalia*, Hall. At least some of the Devonian forms have been redescribed, in an equally unsatisfactory manner by Hall,† as species of *Lichenalia.* This genus, although closely allied to *Fistulipora*, should, I think, be held as distinct. Fig. 5, Plate III., represents a a tangential section of *Lichenalia concentrica*, Hall, the type of the genus, and shows the only reliable character by which the genus can be distinguished from *Fistulipora.* By comparing this section with those of three typical species of *Fistulipora* represented on the same plate by figs. 1, 2, and 3, we find, that while the zoœcia of the latter are sub-circular in form, and thin walled, those of *L. concentrica* have thicker ring-like walls, and a sub-pyriform outline, the walls being sharply inflected and recurved at two points near each other. This bidenticulate character of the zoœcial apertures is stated by Hall to have been observed in nine of the nineteen Devonian species described by him; and as it is the only important character wherein *L. concentrica*, the type of the genus, differs from typical species of *Fistulipora*, it must be regarded as the distinctive generic character of *Lichenalia.* If, however, the importance of the feature is not admitted, then the name *Lichenalia* must be abandoned. On the other hand, if its value is conceded, then the genus must be restricted to species with thin, lamellate or bifoliate zoaria, and more or less dis-

* Proc. Acad. Nat. Sci. of Philad.

† Bryozoans of the Upper Helderberg group. In this pamphlet Prof. Hall describes no less than nineteen species of *Lichenalia.*

tinctly bidenticulate zoœcial apertures. Thus restricted *Lichenalia* is a useful and natural division of the *Fistuliporidæ*.

Fistulipora carbonaria, n. sp. (Pl. III., figs. 1, 1*a*.)

Zoarium irregularly lamellate or sub-massive, several inches in diameter; thickness variable, not known to exceed 0.6 inch. Zoœcia with oval or circular apertures, about 1-50th of an inch in their long diameter, surrounded by a thin inconspicuous peristome; separated more or less completely by a single row of very unequal, angular, vesicular cells, which, at rather irregular intervals, are aggregated into substellate clusters or maculæ. In the spaces between these clusters, nine or ten cells occur in the space of 0.2 inch.

Tangential sections (Pl. III., fig. 1) show that the zoœcia are subovate, very thinwalled, and often contiguous at limited points. The interstitial vesicles are very irregular, are unequal in size, and never, excepting in the maculæ, occur in more than a single series, between the zoœcia.

In longitudinal sections (Pl. III., fig. 1*a*) the anterior wall of the zoœcia is generally flexuous or corrugated, the other side being straight; between the walls the space is traversed by straight diaphragms, recurring at intervals of a half tube diameter or slightly more. Vesicular tissue not closely woven, composed of comparatively large but unequal lenticular vesicles.

This species probably finds its nearest ally in *F. minor*, McCoy, from which it differs in having the zoœcia separated by much narrower interspaces, and in having these occupied by only a single instead of a double series of vesicles. That species also is not known to have maculæ.

Formation and locality: Not uncommon in the Upper Coal Measure deposits at Kansas City, Mo.

Fistulipora prolifica, n. sp. (Pl. III., figs. 2, 2*a*.)

Zoarium large, irregularly laminar or sub-massive, as much as four or five inches in diameter, and one to two inches in thickness; upper surface celluliferous, irregularly undulating or lobate; under surface attached at one point to some foreign body, the rest free and covered by a strongly wrinkled, thin epitheeal membrane. Zoœcia with a faint peristome, sub-circular apertures, about 1-75th of an inch in diameter, and separated from each other about the same distance;

about nine occur in the space of 0.2 inch. Interstitial spaces, in the worn condition, smooth; but in a good state of preservation show small irregular pits. At intervals of two or three-tenths of an inch the surface presents comparatively large, sometimes slightly elevated, substellate "maculæ." These, though varying more or less in size and distribution, are still a characteristic feature of the species.

Tangential or transverse sections (Pl. III., fig. 2) show that the zoœcia have thin walls, that they are subcircular, and separated by a space equalling or slightly exceeding their diameters; each is surrounded by a row of the small angular interstitial vesicles, so that there exist two series of the latter between any given pair of the former. The maculæ are distinct in these sections, being composed of a large number of the small interstitial cells.

In longitudinal sections (Pl. III., fig. 2*a*) the tube walls are thin and comparatively straight; at intervals of about a tube diameter the zoœcial cavity is traversed by diaphragms. The vesicles in the interstitial spaces are small, and form a closely woven tissue.

The small size of the interstitial vesicles, and the closely woven tissue formed by them, are the principal distinctive features of the species.

Formation and locality: In the St. Louis Group of the Lower Carboniferous, near Colesburg, Ky.

FISTULIPORA EXCELENS, n. sp. (Pl. III., figs. 3, 3*a*, 3*b*.)

Zoarium irregularly lobate, occasionally sub-ramose, with internal cavities lined by an epithecal membrane, or forming thin expansions, with the lower side irregularly striated, both radially and concentrically; actual thickness, so far as observed, never exceeding 0.4 inch, usually less than 0.2 inch. Zoœcia regularly arranged in series, with apertures circular, 1-90th to 1-80th of an inch in diameter, and margined by a distinct, nearly equally elevated peristome. At intervals of 0.15 inch, more or less, the surface presents small, substellate maculæ, from which the zoœcia appear to radiate in all directions; in the immediate vicinity of the maculæ they have larger and more oblique apertures; in the intermediate areas five cells are ranged in 0.1 inch. Interzoœcial spaces usually of less width than the diameter of the cell aperture, concave, generally smooth and solid, sometimes, apparently, minutely pitted. The last character is very likely deceptive, as the interstitial spaces of the same specimens, when greatly magnified, seem to be smooth.

Tangential sections (Pl. III., fig. 3) show that the zoœcia are circular or ovate, thin-walled, and separated by a single series of large angular interstitial vesicles, a number of which at sub-regular intervals form groups that represent the maculæ observed on the surface of the zoarium. Just below the surface the interstitial vesicles, though still recognizable, are filled by an apparently homogenous deposit.

In vertical sections (Pl. III., fig. 3*a*) the zoœcial tubes are at first prostrate, then gradually bent upward until they are nearly perpendicular; anterior wall more or less flexuous; diaphragms horizontal, a tube diameter or less distant from each other. Vesicular interstitial tissue composed of comparatively large vesicles, which are more or less obscured near the surface by a secondary deposit.

This is a fine species, and readily distinguished from the associated *Lichenalia* species by its lobate or utricular growth, and if that fails, by its circular, uninflected cell apertures and concave interspaces.

Formation and locality: Common in the Kaskaskia Group, at Tateville, Litchfield, and other localities in Kentucky.

FISTULIPORA (?) CLAUSA, n. sp. (Pl. III., figs. 4, 4*a*, 4*b*.)

Zoarium consisting of compressed branches, two inches or more in height, from 0.2 to 0.6 of an inch in width, and from 0.07 to 0.15 of an inch in thickness. At intervals of about 0.18 inch, measuring from center to center, the surface exhibits sub-stellate maculæ, between which the zoœcia are uniformly distributed in very regular oblique series, so that ten occur in the length of 0.2 inch; in the immediate vicinity of the smooth maculæ the furrows separating the series of cells are usually widest. In the younger examples the zoœcial apertures are elliptical or circular, and oblique, the posterior margin being prominently elevated; the orifice is in many specimens closed by an operculum, with a rather large perforation extending from the center of the lid to near the lower margin. With age the apertures gradually become more direct and smaller, until they are completely closed by a thin membraneous, apparently imperforate covering, beneath which they are still to be recognized, their positions being marked by small papillæ. Interstitial spaces flat or slightly concave, usually smooth, frequently very minutely pitted or granulose.

Tangential sections (Pl. III., fig. 4*a*) passing through the zoarium just below the surface show that the interstitial spaces are occupied by a dense deposit. My tangential sections do not show *positively*

that this deposit was perforated, but judging from the evidence at hand, and especially that afforded by one of the vertical sections, and the very minute pits shown in many specimens, I should say that such was actually the case, and I do not doubt that I will yet find a section that will show it in an unquestionable manner. The zoœcia are elliptical, and at a deeper level are separated generally by one or two series of small angular interstitial vesicles; one section, prepared from an old example, shows occasionally three rows. The zoœcial walls are very thin in front, becoming gradually much thicker on the posterior side. In old specimens the anterior portion of the wall is also appreciably thickened just below the surface.

In longitudinal sections (Pl. III., fig. 4*b*) the zoarium is centrally divided by a thin but double lamina, to which the small end of the tubes is attached, and from which they proceed with a gentle curve obliquely outward to the surface. The upper or anterior wall is wavy and thin throughout the entire length, excepting in old examples, when at the aperture it is slightly thickened by a secondary deposit on the inside. The lower or posterior wall is always much less sinuous, and in the outer portion of the zoarium appreciably thickened. The tube cavity is crossed by straight diaphragms, a tube diameter or a little less distant from each other. Interstitial vesicles at first large, gradually becoming smaller and more numerous toward the surface, near which the space occupied by them is filled by a dense deposit of sclerenchyma, varying in thickness with age. In one section there are very good indications that the deposit was perforated by minute vertical canals.

In transverse sections the central lamina, which separates the zoarium into two equal portions, does not extend through to the edges of the branch. The duplex character of the lamina is, in some places, distinctly shown, and between the two plates there is a series of capillary tubes, which in this kind of section are divided transversely, and consequently have a longitudinal direction. On each side of the median line there is a series of small quadrangular cells; between these and the dense peripheral region, extending completely around the branch, the interstitial vesicles are at first large, then gradually decrease in depth outwardly, at the same time also increasing in numbers.

In the characters of the zoœcia and form of the zoarium this species differs considerably from the typical forms of the genus, and I am not certain that an examination of other similar species will not

make it desirable to separate them generically from *Fistulipora.* The zoœcia in having the wall thin anteriorly, and much thicker posteriorly, resemble those of *Cheilotrypa*, but here the resemblance, excepting in characters common to the family, appears to cease. Yet, if the central laminæ, which, as I have described, do not extend to the margins of the branch, were, instead of being grown together, separated so as to form a tube, we would have all the essential characters of that genus. Although these suggestions imply that the species is more nearly related to *Cheilotrypa* than to the typical forms of *Fistulipora*, I have decided, provisionally, to refer it as above. When my investigations shall have been completed I may be able to make a better disposition. The discovery of capillary tubes between the median laminæ in *F.* (?) *clausa* is highly interesting, as such tubuli are characteristic of *Pachydictya*, Ulrich, and other forms now placed with the *Stictoporidæ.*

The compressed branches of this species will distinguish it from all associated Bryozoa.

Formation and locality: Common in the Kaskaskia Group, at Tateville, Ky., and many other localities in Kentucky and Illinois.

Cheilotrypa, n. gen.

Zoaria ramose, branches with a small, irregularly expanding and contracting central tube, to which the lower or inner ends of the zoœcia are attached. Zoœcia with the posterior portion of the wall usually thickest, gradually thinning on the sides until it is linear at the front; cavity elliptical in tangential section; aperture oblique, the lower portion strongly elevated. Interstitial spaces vesiculose; vesicles open except near the surface, where they are more or less filled and obscured, by a dense, apparently homogenous, deposit of sclerenchyma. Zoœcial apertures sometimes closed by an operculum. Diaphragms wanting or few.

Type: *C. hispida*, n. sp., Kaskaskia Group.

Only two species have been examined that I can with certainty refer to this genus. These are the type species, and *Trematopora ostiolata*, Hall, from the Niagara Group in New York. Superficially, the las resembles the *Trematopora osculum*, Hall, from equivalent rocks in Indiana, in a striking manner. Sections, however, prove beyond a doubt that they are very distinct, *T. ostiolata* being unquestionably congeneric with *Cheilotrypa hispida*, and *T. osculum*, as undeniably, a species of *Coeloclema*, a genus of the *Ceramoporidæ.* The longi-

tudinal and transverse sections of *Cheilotrypa ostiolata* on Plate III., figs. 7 and 7*a* show the axial tube, and other characteristic features of the genus. Tangential sections show that the zoœcia are obovate, being rounded more acutely below, and separated from each other by a single series of comparatively large interstitial vesicles, which, at somewhat irregular intervals, form small, inconspicuous groups or maculæ.

The characters above ascribed to the genus are, I think, sufficiently different from those marking the other genera of this family, to warrant the new generic division.

CHEILOTRYPA HISPIDA, n. sp. (Pl. III., figs. 6, 6*a*, 6*b*, 6*c*, 6*d*.)

Zoarium ramose, branches cylindrical, small, from 0.04 to 0.08 of an inch in diameter, dividing irregularly at variable intervals. Zoœcia arranged in quite regular obliquely intersecting series, in which eight or nine occur in the space of 0.1 inch; small maculæ, around which the cells are a little larger than usual, are generally present; cell apertures oblique, sub-elliptical, or circular, 1-120th of an inch in the long or vertical diameter, with the margin strongly elevated and arching on the lower or posterior side; lip gradually diminishing on the sides, until it becomes obsolete at the anterior end of the aperture. Interstitial spaces and maculæ smooth and concave, wider than the zoœcial apertures, which in some specimens are closed by opercula.

Tangential sections (Pl. III., fig. 6*a*) show that just below the surface of matured examples the interstitial spaces are filled by a dense deposit of sclerenchyma, in which the elliptical zoœcia are distinctly defined; their walls are comparatively thick below, and linear on the upper side. At a lower level the interstitial vesicles are shown. These are small and form between each pair of zoœcia two, often three rows.

Longitudinal sections (Pl. III., fig. 6*b*), passing through the center of a branch, show the irregular axial tube, to which the small or inner ends of the zoœcia are attached. Many of the zoœcia have the apertures closed, and farther down are crossed by a few exceedingly thin diaphragms. The interstitial spaces enlarge rapidly and are occupied by a closely woven vesicular tissue. The vesicles may remain open to the surface, where a dense interstitial deposit closes them; or, as was the case in the section figured, this deposit may extend to a deeper level.

Transverse sections (Pl. III., figs. 6*c* and 6*d*) clearly show the vari-

able character of the axial tube. Attached to the tube is a cycle of from seven to nine somewhat wedge-shaped cells, with very thin walls. Between these and the more or less dense or thick-walled peripheral region, is another circle of thin-walled cells. The characters observed in sections of this kind are very well shown in the figures referred to.

It is not probable that this pretty little species will be confounded with any associated bryozoan, as none of the small ramose species known to me in the Kaskaskia Group have the margins of the cell apertures prominent.

Formation and locality: This is a very common species at Tateville, Ky., and other localities where the Kaskaskia Group is exposed.

ERRATUM.—For *Fossils* in headlines read *Bryozoa.*

[TO BE CONTINUED.]

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Chas. M. Woodward
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S. E. Wright.
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* Deceased.

Vol. VII. No. 2.

THE JOURNAL

OF THE

CINCINNATI

Society of Natural History.

Publishing Committee.

JAMES W. ABERT, A. P. MORGAN,
GEO. W. HARPER, DAVIS L. JAMES,
WALTER A. DUN.

JULY, 1884.

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CONTENTS.

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* Omitted from the Table of Contents on cover of the April number.

THE JOURNAL

OF THE

Cincinnati Society of Natural History.

Vol. VII. Cincinnati, July, 1884. No. 2.

PROCEEDINGS OF THE SOCIETY.

Tuesday, *April* 1, 1884.

ANNUAL MEETING.

President Hunt in the Chair. Twenty-eight members present.

The minutes of the Executive Board for January, February and March were read.

The Treasurer, Mr. S. E. Wright, read his report for the year ending April 1st.* The report was received and referred to an Auditing Committee, consisting of Dr. R. M. Byrnes, Davis L. James and Dr. W. A. Dun.

The reports of Dr. O. D. Norton, curator of Botany; Mr. Wm. Hubbell Fisher, curator of Ornithology; Dr. A. E. Heighway, Jr., curator of Herpetology; Dr. A. J. Howe, curator of Comparative Anatomy; Mr. E. M. Cooper, curator of Conchology; Prof. J. W. Hall, curator of Mineralogy; Dr. A. E. Heighway, Jr., Librarian, were read.

The Custodian, Prof. Joseph F. James, read his annual report upon the condition of the Museum.

The reports were received and referred to the Committee on Publication.

The amendment to the By-Laws proposed at the preceding meeting was read.†

Dr. Walter A. Dun moved an amendment to the amendment as follows: by adding to the amendment proposed the following words: "And a non-member shall not be allowed to read a paper before this Society unless

* This, and the other reports mentioned below, will be found in another part of this journal.

† See page 4 of present volume.

especially invited to do so by the Society or the Executive Board." The motion was seconded by Mr. Skinner.

There being objection to the passage of this amendment without lying-over for one month, on the ground of its embodying a new proposition Dr. Dun withdrew his motion with the consent of his second.

The original amendment to the By-Laws was then unanimously adopted.

Dr. Dun then offered the amendment as above written, and it was laid over for action at the next meeting.

The Society then went into an election of officers, to serve for one year. The following persons were elected to fill the offices set down opposite their names:

President, ...	Dr. J. H. Hunt.
First Vice-President, . . .	Prof. Geo. W. Harper.
Second Vice-President, . . .	J. R. Skinner.
Secretary, ...	Davis L. James.
Treasurer, ...	S. E. Wright.
CURATORS.	
Paleontology, ...	E. M. Cooper.
Botany, ...	Miss Sarah C. Stubbs.
Ornithology, ...	Wm. Hubbell Fisher.
Icthyology, ...	Dr. D. S. Young.
Anthropology, ...	Dr. W. A. Dun.
Comparative Anatomy, . . .	Dr. A. J. Howe.
Herpetology, ...	A. E. Heighway, Jr.
Mineralogy, ...	J. W. Hall, Jr.
Conchology, ...	Mrs. M. C. Moorehead.
Entomology, ...	Charles Dury.

Members at large of the Executive Board: Col. J. W. Abert, Dr. W. A. Dun, A. P. Morgan, E. M. Cooper.

Trustee for two years: Julius Dexter, Esq.

Donations were received as follows:

From the U. S. Fish Commission, Reports for 1872-3, '79-80; from Ottawa Field Naturalist's Club, Transactions No. 4, 1882-3; from Davis L. James, Annual Report Rochester Society of Natural History, Dec. 1883; from Bureau of Education, Washington, Circular of Information No. 3, 1883; from Chief Signal Service Officer, Weather Review, January, 1883; from Theodore Gill, Washington, D. C., Principles Zöogeography; from Dr. E. G. Betty, Portrait of John L. Talbott; from Secretary of the American Institute of Mining Engineers, Proceedings of Annual Meeting, Cincin-

nati, February 19, 1884; from Allen M. James, two specimens marine shells; from E. M. Cooper, one malformed hen's egg; from Dr. W. A. Dun, two coccoons.

Adjourned.

TUESDAY, *May* 6, 1884.

SCIENTIFIC MEETING.

President Hunt in the chair. Fifteen members present.

Prof. Joseph F. James read a paper on "Pollen, its development, forms and uses." The subject was prefaced by an account of the courses of instruction for teachers and advanced students which are now afforded by the large Museums and Academies of Science in the Eastern cities. The paper was fully illustrated with pictures prepared by the author and projected upon a screen, Dr. Hunt assisting with the lantern.

The paper was referred to the Publishing Committee.

The committee appointed at the annual meeting to audit the Treasurer's accounts, reported as follows:

CINCINNATI, *May* 2, 1884.

To the President and Members of the Cincinnati Society of Natural History:

Gentlemen—Your Committee appointed at the annual meeting April 1, 1883, have examined the report of the Treasurer, Mr. S. E. Wright, for the year ending April 1, 1884, and find the same to be correct; and would most heartily commend the manner in which the accounts are kept. They also congratulate the Society upon being favored with the gratuitous services of so faithful and efficient an officer.

Respectfully submitted,

R. M. BYRNES,
DAVIS L. JAMES, } Committee.
WALTER A. DUN,

The report was received and the committee discharged.

The amendment to the By-Laws, submitted at the April meeting by Dr. Dun, was unanimously adopted.

Donations were received as follows:

From Bureau of Education, Washington, Circulars of Information No. 5, 1873, No. 1, 1884, Report of Director of American School of Classical Studies, at Athens. 1882-3; from W. H. Linney, two Geological Maps of Spencer and Garrard, and Mercer and Garrard Counties, Ky.; from Davis L. James, Report of Superintendent of Coast Survey, 1852; from Chief

Signal Service Officer, Weather Review, February, 1884; from Smithsonian Institution, Proceedings of U. S. Nat. Museum, Vol. VI, Nos. 24, 25, 26; from Sam'l Garman, Cambridge, Mass., List of N. American Reptiles and Batrachians; from H. C. Stewart, one specimen hornet's nest; from Dr. A. J. Howe, one fossil; from U. P. James, five species fossil corals — types of M. circularis, James, M. welchi, James, M. communis, James, M. dychi, James, Fistulipora oweni, James; from Col. J. W. Abert, specimen of pulverized gold ore.

TUESDAY, *June* 3, 1884.

SCIENTIFIC MEETING.

Col. J. W. Abert, Chairman, pro tem. Sixteen members present.

Mr. E. M. Cooper read a paper entitled "Some Curious Animals," and exhibited a series of photographic lantern pictures in illustration of his subject. The pictures were prepared by Mr. Charles N. Woodward and were donated to the Society's collection.

Mr. Woodward received a vote of thanks for his gift.

Prof. Joseph F. James remarked upon variations of Trifolium pratense. The text-books describe it with sessile heads and spotted leaflets. He had observed it frequently with peduncled heads and spotless leaves. He also presented the Society with thirty (30) species of plants, mounted and named, as the nucleus of a collection to embrace the Flora of Cincinnati. He desired members who might come into possession of rare or fine specimens to send them to the rooms, where they would be dried, mounted and placed in the herbarium, with proper acknowledgment.

Mr. Davis L. James exhibited specimens of the White Water-Crowfoot, Ranunculus aquatilis, a plant which has been considered scarce in this region. The specimens were from near Glendale.

Dr. R. M. Byrnes said that he had that afternoon seen specimens from Ross Lake, where he had been told it is quite abundant.

A paper by Mr. U. P. James was read by title as follows: "Description of four new species of Fossils from the Cincinnati Group." The paper was referred to the Publishing Committee.

It was announced that the Curator of Botany wished to establish a Botanical Section, and Saturday, June 7, was named as a day for a meeting for the purpose.

Dr. Heighway offered to present the Society a collection from the Yellowstone Geyser region, if it would provide a case for it.

The Society thanked the Doctor for his offer and referred the matter to the Executive Board.

Donations were announced as follows:

From the U. S. Fish Commission, Bulletin, Vol. iv, Nos. 1, 2, 3, 4, 5, 6, 7, 8; Chief of Engineers, Washington, Reports on Preservation of Timber, Building Stones, of Explorations in Nebraska and Dakota in 1855-1856-1857, by Lieut. Warren, of Reconnaissance from Carroll to the Yellowstone, in 1875; from Mrs. M. C. Moorehead, thirteen species of shells; from Museum of Comparative Zoölogy, Cambridge, Hamlin on Syrian Molluscan Fossils; Signal Service Bureau, Monthly Weather Review, March, 1884; from Otis T. Mason, Washington, D. C., Notes on Anthropology for March, April and May, 1884; from Entomological Society of Ontario, Report for 1883; from Smithsonian Institution, Proceedings U. S. National Museum – Sigs. 27, 28, 29, 30, 31; from Edward M. Cooper, Proceedings of the Worcester Society of Antiquity for 1883; from Miss Marie Mohr, large collection of dried plants from Alabama, Ohio and Europe; from Jos. F. James, thirty-one species of mounted plants, as a nucleus for a Cincinnati Herbarium; from Dr. R. M. Byrnes, two specimens Cardamine diphylla; from Jos. F. James, two species seeds; from W. Andrew, one fossil; from Dr. J. H. Hunt, two magic lantern pictures; from C. N. Woodward, 22 lantern pictures; from U. P. James, one snake.

REPORTS OF CURATORS
AND
THE CUSTODIAN,

FOR THE YEAR ENDING APRIL 1, 1884.

CINCINNATI, O., *March*, 1884.

To the President and Members of the Cincinnati Society of Natural History:

GENTLEMEN – The additions to the collection of Mineralogical specimens have not been large during the past year. We have had one exchange by which some twenty new species have been secured. The total addition was seventy-five specimens. I have lately been maturing a plan, and in furtherance of it have been in correspondence with Prof. A. E. Foote, of Philadelphia, and Ward & Howell, of Rochester, by which we can have a good set of rocks scientifically arranged, classified and labeled. Our minerals, as a general thing, are good, and fairly classified and labeled, but

our rocks are not. These are now, in all well regulated cabinets, placed separately from the minerals proper. We have room in our present cases for a much larger number of species of minerals by taking out the duplicates and placing them on the exchange list. I am making out a list of what we need to make our collection a profitable one for our young folks to study as well as attractive to our citizens and stranger visitors. When complete I shall present it, with the probable cost, and hope that our Honorable Board will furnish the amount requisite for the purchase.

Yours, very truly, J. W. HALL, JR.,
Curator of Mineralogy Cin. Soc. Nat. History.

CINCINNATI, O., *April*, 1884.

GENTLEMEN OF THE CINCINNATI SOCIETY OF NATURAL HISTORY:—Enclosed with my Annual Report you will please find the following supplementary suggestions which, if acted upon favorably, will add very materially to the value of our collection as well as interest. I have spent considerable time and care in making a selection of rocks which will show each formation from Archæan to recent, and have them stratagraphically arranged. I find that Ward & Howell have precisely the specimens we want, and they will send 100 specimens, carefully labeled, with formation and locality, and on blocks. We also need very much a *lithological* series of rocks, which will contain not only the rocks that will likely be met with by ordinary observers, but characteristic and typical rocks of the most important varieties. This series will contain 100 specimens, located and named properly. This series will cost about $45 and the first $50; total $95, for 200 specimens I intend to rearrange the whole collection if these series are granted as a basis. In the rearrangement I will select specimens and make a separate collection illustrated; 1st, Structural and Phenomenal Geology, with the following divisions: "Varieties" of Structure, Concretionary, Cellular, Porphyritic, Stratified, Texture, Veins, Metamorphism, etc.; also, 2d, another case showing tests of minerals, as Lustre, Color, Dichroism, Diaphaneity, Refraction, Polarization, Cohesion, Aggregation, Form and Crystallography. I shall be happy to meet with any committee and explain more fully my plan and how it can be done with comparatively little expense. We need to have our collection in all departments not merely *deposited* for *safe keeping*, but it should be arranged so as to have a scientific and educational value. With the suggestions offered I think we can have a valuable change, not to be estimated on a money basis.

Yours, very respectfully, J. W. HALL,
Curator of Mineralogy, C. S. N. H.

CINCINNATI, *April* 1, 1884.

CINCINNATI SOCIETY OF NATURAL HISTORY:—The department of Conchology is one of the most attractive in our Museum, and while the additions to the collection during the past year have been comparatively few, being some twenty-five species only, still a number of these have been rare and attractive; amongst the number being the rare and valuable species Voluta junonia, kindly presented by Mr. T. H Aldrich. A great number of specimens still remain undisplayed—this being specially true of the Lamellibranchs, and particularly of the Freshwater Shells—the cause being a lack of case room. In my report last year I urged upon the Board the necessity of additional case room for the display and care of these interesting and attractive specimens, and I would again respectfully request the purchase of either additional flat cases, such as we now have, or of drawers with glass tops, as are used in the Philadelphia Academy. Our library also lacks books of reference on the subject of Conchology, and a small sum might be judiciously expended in purchasing such books as would not only assist the custodian, but prove of value to the members.

Respectfully, ED. M. COOPER,
Curator of Conchology.

CINCINNATI, *April* 1, 1884.

MR. PRESIDENT:—The undersigned begs leave to report that during the past year very valuable additions have been made to our splendid Herbarium, which has been very carefully arranged according to Bentham & Hooker's sequence of orders, affording complete facility for the ready examination of the specimens which now number nearly 3,600 species; a large collection of seeds and a fine variety of specimens of woods have been added, besides some forty-seven species of pine cones, collected by the late Dr. Warder, many of them mounted in handsome wall cases. Very valuable additions also to the library have been made in this department, so much needed, and supplying the long felt want. We now have Bentham & Hooker's Genera Plantarum, Sach's Text-Book of Botany, Gray's Flora of North America, McAlpin's Botanical Atlas, and Chapman's Flora of the Southern States, and as our large Herbarium has quite outgrown the old and very defective case, we would most respectfully urge the necessity of having a new one constructed on the most approved plans and in every way suitable and worthy of our growing collection.

Very respectfully, DR. O. D. NORTON,
Curator.

Cincinnati Society of Natural History:

GENTLEMEN—My Ornithological report as Curator is as follows:

The collection of mounted birds has been enriched by the addition of twenty-three specimens, among which are

1 Golden Eagle *Aquila chrysaëtus* (L) Cuv.

1 Muscovy Duck, *Carina moschata*, male.

1 Shoveler (Broad Bill) Duck, *Spatula clypeata* (L) Boie.

1 European (White) Swan, *Cygnus oler, adult*.

1 European (White) Swan, *Cygnus oler*, being young in downy plumage.

2 Black Swans.

These birds are well mounted, and with the exception of one of the swans, appear to be fine specimens.

Also two cases of mounted birds were received so badly damaged as to be worthless for our use.

To the collection of bird skins there have been added three specimens. The skins of the collection are well preserved and appear to be free from destroying insects and vermin in general.

The collection, is quite comprehensive as to our local fauna, but is lamentably lacking in specimens whose habitat is confined to regions other than our own. The Society possesses only a few of the species peculiar to the Western or Southern United States.

When at Washington, D. C., I ascertained that the Smithsonian Institute would exchange only for the particular specimens they desired. An examination of the printed list of *desiderata* of that Institute disclosed the fact that this Society had few or no specimens which the Smithsonian Institute wanted, and which we could spare.

Attention was then directed towards exchanges with Ornithological collections in various parts of the country.

After due consideration it was decided that the completeness of series of specimens of bird skins owned by this Society would be interfered with if exchanges were made from them. I would therefore recommend that additional specimens of our local fauna be obtained for the purpose of exchange with Western and Southern Ornithologists. These local specimens may be obtained by purchase, and also probably by donation. If all the collectors of this Society would be at the trouble to get such local specimens as fall within their reach, the Society would soon have on hand desirable specimens for exchange.

The receptacles for the bird skins are ample in point of mere size. There is a need, however, of economizing the space these receptacles provide.

The smaller birds greatly outnumber the larger ones, and are now crowd-

ed together. Should one specimen be affected with vermin it is likely to transmit these vermin to the remaining birds in the drawer. Furthermore, the plumage of the skins becomes more or less ruffled and disturbed, and the skins are not in position to be used in scientific study or examination. Some of the drawers of nine inches in depth have an overplus of small skins, which latter, if laid flat side by side, would not require a space vertically of more than two or three inches. The remedy for this is to provide simple adjustable wooden trays (which can be furnished at a nominal expense) and which can be fitted into these drawers, thus doubling, and sometimes trebling the drawer space, and enabling the specimens to be properly disposed and easily and quickly reached and examined.

The cases for the exhibition of mounted birds and mammals are also obviously inadequate.

In regard to the department of mammalogy, during the year twenty-one mounted mammals have been added to our collection, many of which are rare and fine. Among these may be mentioned the porcupine, Malayan *Sun* bear, *Ursus Malayanus:* Mexican free porcupine, female, *Springurus Mexicanus* Shaw Honduras: axis deer: *Cervus axis,* female, India: kangaroo: fine specimens of monkeys: jaguar: raccoon: fawn of hog deer (Cervus porcinus, *Zimm.*, Indian species, twenty-four hours old): prairie hare, etc.

Books added to the Library are Zoological atlas, Mivart's. vol. entitled "The Cat," etc.

With the earnest wish that the collection of birds and mammals may be increased, and become of still greater value to the student of Natural Science, this report is respectfully submitted.

Your obedient servant, WM. HUBBELL FISHER.

Cincinnati, O., April 1, 1884.

Report of Curator of Comparative Anatomy:

The cabinet embraces a variety of skeletons, mounted and unmounted. The entire skeleton of an emu, in ligaments, has been added this year. The skull of a six-banded armadillo is an addition, and several odd bones of some interest.

The custodian is in progress of cataloguing skeletal forms. He has put in order the case of avian shoulder girdles.

An appropriation of ten or fifteen dollars should be made to finish the articulation and mounting of the skeleton of the African ostrich. In short, the osteal museum on the fourth floor should have work and money displayed upon it.

During the year some rare and valuable mounted specimens have been added to the museum of the second floor. Among the additions may be mentioned a young jaguar, a large kangaroo, Malayan sun bear, a genet, a civet, bush cat, African porcupine, tree porcupine, armadillo, albino raccoon, axis deer, fawn of hog deer, prairie hare, group of monkeys, etc.

It would be well for the library to buy the "Standard Natural History," a book of six volumes, the cost of which would be twenty-five or thirty dollars.

The above is respectfully submitted. A. J. Howe.

Cincinnati, *April* 1, 1884.

Society of Natural History:

The collection has been named as far as possible, and is arranged in one of the cases so as to be seen to the best advantage.

Three new specimens have been added.

Very respectfully, A. E. Heighway, Jr.,
Curator of Herpetology.

Report of the Custodian of the Cincinnati Society of Natural History.

To the President and Members of the Cincinnati Society of Natural History:

In accordance with the usual custom, your Custodian presents the following report of work done during the year ending April 1, 1884. As the curators of the various departments have presented their several reports, but little remains to be said, and it will be said briefly:

The time has been largely spent in cataloguing and arranging the specimens already in the cases, and placing the additions in their respective departments. A card catalogue of the Ichthyological collection has been completed, and in such a way that the descriptions of the different species can be readily consulted. A plan of an accession catalogue has been adopted, and it is the purpose to enter in this all the new specimens received, designating each with a number so that its history will not be lost. Uncatalogued specimens of the museum will also be entered in this book, so that eventually everything will be found here. This plan is subsidary to a card catalogue, however, as the last is the only true way of keeping an account of the specimens in the different departments of the museum.

The additions to the various departments have been referred to by their several curators. They have not been as numerous as might be wished, but in the Library the additions have been important. New names of

societies have been added to the exchange list, sets of proceedings of old societies have been completed, and there is now an excellent foundation for a valuable scientific library. It has been partially catalogued, and the books are thus made more readily accessible, especially the bound volumes of pamphlets.

The Museum has been visited during the year by over 2,200 persons. A small number, perhaps, but an increase over last year, and an indication of the growing importance of the Society. The schools have used the Museum largely, and have thus derived much benefit.

On the 23d of May last, the 176th anniversary of the birth of Linnæus, a reception was given by the Society to invited guests. About one hundred persons were present Papers were read upon the life and upon the botanical and the zoölogical labors of the great naturalist, and at the conclusion of the exercises an informal exhibition of microscopic objects was given.

The feature of the year just past has been the institution of courses of free lectures. During the summer a series of ten lectures on Botany was delivered. These were given on Saturday mornings from June to August, and, notwithstanding they came in the middle of summer, when many who would have attended were away from the city, the course was quite successful. This induced the Executive Board to arrange for others, and during the fall and winter, from October to March, fourteen lectures on various branches of science were delivered to appreciative audiences. All these were free, and excited a considerable degree of attention among persons interested in scientific pursuits. There were treated subjects connected with zoölogy, botany, geology and archæology, and while they were well attended, it would appear that the range of subjects was too wide to have justice done to any one of them. In arranging for such lectures again it would be well to devote the six or eight to one branch of science, say to geology, or palæontology, or conchology, or entomology, and in this way to cover the ground in a more systematic and thorough manner. Through the medium of courses such as these, properly conducted, the society could be made one of the leading educational institutions of the city. The matter has been brought more forcibly to my mind since reading a notice of the address of Prof. Bickmore, of the American Museum of Natural History of New York City, before the Department of Superintendence of the National Educational Association at Washington last year. In his opening remarks Prof. Bickmore said :

"About two years and a half ago the authorities of the museum with which I am associated addressed a letter to the Board of Education of our city, suggesting that they select a limited number of their teachers to come

up to our institution, and that I should give them conversational talks (we scarcely call them lectures) upon the objects that we had on exhibition in our halls. It proved to be an extremely stormy day in winter when the first gathering took place, but all those invited were present, and we were at once impressed with the magnitude and importance of the work thus thrust upon us. The attendance of the teachers was so constant that the six informal talks were extended to eighteen or twenty. The Board of Education then addressed us a letter expressing their high estimation of the work thus begun and asking that fifty teachers be allowed to be present at the next course. At the conclusion of these lectures the Board wrote us another letter stating that there were one hundred and four schools in our city under their direction, and asking if accommodations could be made for at least one teacher from each of them, in order that there might be a distinct, definite influence going out from our Museum every week to each school, conveying important instruction and aiding the teachers to give the most complete information to their pupils upon human and comparative anatomy and zoölogy and other subjects upon which the board might require oral instruction to be given in the common schools. A course on zoölogy is now in progress, and every Saturday our little hall is filled to overflowing."

Is there not in some such course as this ample scope for work for this Society? It is here thrown out as a hint, but I hope in a short time to give a practical demonstration of Prof. Bickmore's plan, show how important it is, and how helpful it is in teaching.

JOS. F. JAMES,
Custodian C. S. N. H.

April, 1884.

CONTRIBUTIONS TO THE FLORA OF CINCINNATI.

BY JOSEPH F. JAMES.

Read and referred to the Publishing Committee March 4, 1884.

The following remarks are the result of observations on the plants of the vicinity of Cincinnati, which have been accumulating during the past two or three years. The Catalogue of Plants of Cincinnati, published in 1879, was compiled hastily, and errors unfortunately crept in. Some of these were corrected, and some additions made in 1881, by Mr. D. L. James The present observations embody the results of study of some of our species and genera, and are here presented in the hope of making our flora better known and of inducing others to study it. Some of the notes have appeared elsewhere, but others are entirely new.

I feel indebted to many persons for information in regard to localities. Most of all, to the late Mr. T. W. Spurlock, one of the most indefatigable students our flora has ever had; to the Misses Mohr, Dr. R. M. Byrnes, Mr. D. L. James, Mr George B. Twitchell, Mr. C. B. Going, Mr. C. G. Lloyd and Mr. A P. Morgan, I am also indebted, and desire to thank for their assistance in making the list more complete than it otherwise would have been.

JOSEPH F. JAMES,

Custodian Cincinnati Society of Natural History.

RANUNCULACEÆ.

7. ANEMONE THALICTROIDES, L., has been considered by many writers *Thalictrum Anemenoides*, Michx. It is still so named in Gray's Manual. and that authority was followed in the catalogue of 1879. Study of the species convinced me that it was more of an *Anemone* than a *Thalictrum*, and in Bull. Torr. Bot. Club, vol x., p. 56, I suggested that the old Linnean name be restored, and for the following reasons: It differs essentially from *Thalictrum* in having an involucre, and agrees in all respects with *Anemone*, except that Dr Gray makes the arbitrary distinction, "achenia—not ribbed." Omit the *not* and let it read, "Achenia pointed or tailed, flattened *or* ribbed," and the generic description of *Anemone* of Dr. Gray will fit admirably the Rue-Anemone. Since making my note to this effect, I find that Bentham and Hooker have placed *Syndesmon*, Hoffm., under *Anemone*, though Dr. Gray considered it a subgenus under *Thalictrum*.

11. TRAUTVETTERIA PALMATA, F. M., was inserted into the catalogue of 1879, on the authority of Mr. Lea's list published in 1849. No one has

since, as far as known, found it here, and it should be dropped from the list as not now occurring.

12. Ranunculus aquatilis, L.—Common White water-crowfoot. This was credited to Mr. Clark, but its late finding by Mr. Going places it again certainly on the list. It was found in great abundance near Glendale, O.

12 a. Ranunculus multifidus, Pursh.—Yellow water-crowfoot. This, an entirely new addition to the flora, has been lately found in a small swamp near Glendale, O., close to the other species.

17. Ranunculus repens, L., is a most variable species, closely allied to R. bulbosus and R. acris. Muller says (Fertl. of Flowers, p. 76) that bees visit the three species one after another indiscriminately. The species might be crossed in this way and the variability be thus accounted for.

BERBERIDACEÆ.

31. Caulophyllum thalictroides, Michx.—This is not a common species, only a few stations being known in this vicinity. It is to be sought for on wooded hillsides with a southern exposure, and is easily recognized by the large, glossy green leaves, and rather small yellowish green flowers. It is in bloom about May 1.

NYMPHAEACEÆ.

34. Nelumbium luteum, Willd.—The large Yellow Nelumbo, or Water Chinquepin, has been, in all likelihood, exterminated in this vicinity. Lea gives it in his list and Clark in his, though in the latter one, published in 1852, it was considered as extinct. In early days it doubtless grew in Mill Creek and in the Licking River, but the progress of civilization has driven it away. In the summer of 1877 I found it quite abundant in a pond back of Jeffersonville, Ind. It should be omitted from our list.

PAPAVERACEÆ.

37a. Chelidonium majus, L., Celandine.—Found in May, 1881, on Mount Auburn, probably escaped from some garden.

CRUCIFERÆ.

48a. Cardamine heterophylla, Wood.—An addition to our flora found in the spring of 1882 near Loveland, O., by the writer. Only a single specimen was to be had, but there is no question as to the identification. It differs from *C. laciniata* in having the leaves alternate, and from *C.*

diphylla in not having the continuous root-stock; the roots consisting of a series of oblong tubers like those of *laciniata.*

The genera *Dentaria* and *Cardamine* have, with good reason, been merged into one by Bentham and Hooker. The differences between them are the habit of growth and the root. In the former genus the leaves are often whorled, or at least are situated near the centre of the stem, and the roots are rhizomes. In the latter genus, the leaves are scattered on the stem, and the roots are mostly fibrous. The flowers and fruit are almost the same in both.

In a revision of the species of the section DENTARIA under CARDAMINE, I have suggested the following arrangement (Bot. Gaz. viii., p. 206):

48. CARDAMINE DIPHYLLA, Wood.—Stem leaves two, opposite; root-stock long and continuous.

48a. CARDAMINE HETEROPHYLLA, Wood.—Stem leaves two to seven, opposite or alternate; root-stock interrupted, of two or three toothed tubers. The forms with more than three leaves are *D. maxima*, Nuttall.

49. C. LACINIATA, Wood.— Stem leaves three, whorled; root-stock nearly as in the last.

Var. multifida, James (*D. multifida*, Muhl.), is a form of *laciniata* with finely dissected leaves. I have found the two forms on Lookout Mountain, Tenn., running into each other in imperceptible gradations.

52a. C. HIRSUTA, L. Var., sylvatica, Gray. Both these forms have been found in our vicinity, but from some oversight they have not been previously recorded.

51. C. ROTUNDIFOLIA, Michx.—*C. purpurea*, Cham. & Schlecht., was inserted into the catalogue of 1879. It was intended to be the var., *purpurea*, of *C. rhomboidea*, D C. This variety is now considered *C. rotundifolia*, Michx., as above, though the description given of this species by Gray is not characteristic of our form. It seldom forms runners, and there are numbers of tubers mixed with the fibers of the root as in the *rhomboidea.*

59a. HESPERIS MATRONALIS, L.—Found by Mr. T. W. Spurlock, in Storrs Township. The stem is simple and erect; leaves lanceolate-ovate, denticulate Flowers purple; blooms from June to August.

65a. ALYSSUM LESCURII, Gray, given in a former list, should be omitted. There was a mistake in the identification.

66. CAMELINA SATIVA, Crantz.—This is given in Lea's catalogue. It has

not been recognized of late as far as is known. It is an introduced plant, with small yellow flowers and lanceolate and arrow-shaped leaves (Gray). It should probably be omitted from the list.

CARYOPHYLLACEÆ.

82. Silene nivea, D C.—This species was first found in our locality by Miss Kate Peachey, along the Little Miami River, near Loveland, Ohio. The patch was a small one, but well established, though subject to overflow by the river, and liable to be buried out of sight under deposits of mud. The flowers are quite large, white, and at a hasty glance are liable to be mistaken for *S. stellata*, Ait., from which they differ, however, in having the petals cleft only, instead of fringed; and the leaves are opposite instead of whorled

86a. Silene noctiflora, L.—Recorded by Mr. C. G. Lloyd as found at Crittenden, Ky. Escaped from cultivation.

PORTULACACEÆ.

98. Claytonia Virginica, L.—Mr. Davis L. James has made some interesting observations on the fertilization of this plant, which are here inserted from his notes.

"If the flower of *Claytonia Virginica* be observed soon after it opens for the first time, the stamens will be found standing erect and around the pistil, the lobes of the style closely pressed together, and none of the stigmatic surface exposed. The anthers are extrorse. The stamens remain erect the first day and the style lengthens slightly. The second day the stamens are mature, they begin to shed their pollen, and are bent towards the petals. The style has been further lengthened.

"On the third day in the life of the flower the filaments are bent outwards and the anthers are now closely pressed on the petals; the style has elongated, its lobes are recurved and the stigmatic surface is exposed. Flowers with reflexed stamens and a mature style, and with erect stamens and undeveloped style, are both found on one plant, the former always below the latter in the raceme. The insect observed in the work of fertilization is a small bee.

"Mr Meehan thinks that the pollen which is shed upon the petals by the ripening stamens is brought into contact with the stigma when the flower closes at night. But as the flower droops as it closes, the pollen would more likely fall to the ground. I have seen the pollen shed upon the petals in but one case. and that was in a plant brought into the house and placed in damp sand. Claytonia is quite fertile with us, not one out

of many hundred plants showing imperfect capsules. Heterostylism was not observed, all the specimens being alike."

The two species of *Claytonia* given by Gray, viz.: *C. Virginica* and *C. Caroliniana* are hard to distinguish. The only difference seems in the leaves. In the first they are linear, and the second "spatulate-oblong or oval-lanceolate" (Gray). As one seems to predominate in the West and South, and the other is a more northern form, it seems probable that the *Caroliniana* is more of a geographical variety than a distinct species. *C. Caroliniana* seems a misnomer, for it is the more northern form of the two.

MALVACEÆ.

107. Napaea dioica, Clayt., was inserted in the catalogue on the authority of Mr. Spurlock, who formerly found it in this vicinity. As it has not been seen for many years it would be wise to consider it extinct in our locality.

109a. Gossypium herbaceum, L. (Cotton Plant).—An introduced plant which has been found growing in the sweepings of freight cars in the yards of the O. & M. R. R., Storrs Township, on the Ohio River bank. The flower is quite large, yellow, turning with age to a reddish-brown; the calyx is subtended by an involucre of three bracts, and the fruit forms a solid boll. It is uncertain if it ripens here. The species can be considered as only doubtfully established.

109b. Hibiscus Trionum, L.—Found at Loveland by Miss K. Peachey, is an escape from cultivation, and may be considered as naturalized.

110. Hibiscus militaris, Cav.—Was found during the summer of 1883 by Mr. George B. Twitchell, growing wild near Delhi, on the C. I. St. L. & C. R. R. This is the first time it has been recorded since Mr. Clark's list was published in 1852, and it thus re-establishes an old species.

GERANIACEÆ.

116. Floerkea proserpinacoides, Willd., is an inconspicuous plant, but has been found in great abundance near Ludlow Grove by Mr. Spurlock. It is a species liable to be overlooked, because of its manner and place of growth; the localities where it is found are damp or swampy.

VITACEÆ.

130. Ampelopsis quinquefolia, Michx., is considered by our latest authorities to be Vitis quinquefolia, Bentham & Hooker.

SAPINDACEÆ.

133. Aesculus flava, Aiton.—Sweet Buckeye. A peculiar feature of this species was noted in a tree growing near Loveland, O. The lowest branches started from the trunk at least twenty feet from the base, and then drooping suddenly came down to within about six feet of the ground, and then spread out horizontally. Nearly all the branches seemed to have the same mode of growth.

ANACARDIACEÆ.

141. Rhus venenata, D.C., is given in Clark's Catalogue. I have never found it here, nor do I know of its having been found lately. It should be omitted from the list.

LEGUMINOSÆ.

143. Trifolium pratense, L.—At the meeting of the Agricultural Congress at Montreal in August, 1882, Prof. W. J. Beal read a paper on the variations to be noticed in the red clover (*Trifolium pratense*). He spoke of the varied habit of growth, it being sometimes upright and sometimes spreading; called attention to the presence or absence of pubescence; to the presence or absence of spots on the leaves; to the variation in the number and color of the seeds, and said that he generally found the heads to be sessile. He further thought that by selection the varieties might be greatly improved. The variation which Prof. Beal did not notice so prominently has been noticed this year (1884) to be very common. In many instances I have found the heads of flowers to be distinctly stalked, sometimes these stalks being as much as two inches long.

In our botanies the distinctions between *Trifolium pratense* and *T. medium* are these: In the former the heads are sessile and the leaflets are spotted; in the latter the heads are stalked and the leaves are unspotted; while a still further difference is given by Hooker in Student's Flora of the British Isles; this is, that the pods of the *T. pratense* open by the top falling off, and those of the *medium* have a longitudinal dehiscence. None of these characters seem to hold good. In some specimens the leaves are spotted and the heads are stalked; in others the heads are sessile and the leaves are not spotted; while all the pods I have examined have a longitudinal dehiscence. Dr. Gray in the Manual says the one species is too near the other, and it would seem from the facts now known that it would be wise to unite the two species under the name of *T. pratense.*

149a. Medicago sativa, L. Alfalfa, Lucerne.—A plant with three parted leaves and blue flowers, extensively cultivated in many places as

food for cattle. It has been introduced in some localities here, has escaped and is well estalished. A large patch can be found near Newton Station on the L. M. R. R., and another on the I. C. & L. R. R. (Twitchell.)

153. ASTRAGALUS COOPERI, Gray.— This was found during the summer of 1883 by Dr. R. M. Byrnes, on the hills west of the city and near Price's Hill Incline. It was given in the catalogue on the authority of Mr. Lea, and its rediscovery is interesting. It differs from our common *A. Canadensis* in having the few flowers more loosely arranged in the spike, and in the pod being one instead of two celled.

176a. CASSIA OCCIDENTALIS, L —Though a native further south, this species has been found occasionally by Mr. Spurlock, growing in company with *Gossypium*, near Sedamsville. Only eight specimens were found, growing in such a situation that they were liable to be covered over or swept away at any time. They did not flower until very late, and only one or two perfected fruit. Another specimen was found by Mr. Going at the Stock Yards (C. W. & B. R. R.), but was killed by the frost before it bloomed.

177. CASSIA TORA, L. (*C. obtusifolia, L.*)—A few specimens were found by Mr. Spurlock on Bank Lick, back of Covington, also by Mr. Going at the Stock Yards with *C. occidentalis, L.*

178a. CASSIA NICTITANS, L.—Found growing on the Ohio River bank by Mr. Spurlock.

As all the five species given in Gray's Manual have been, at times, found in this vicinity, the chief character of each is here appended.

176. CASSIA MARYLANDICA, L.—Tall, with spike of large yellow flowers; six to nine pairs of leaflets.

176a. CASSIA OCCIDENTALIS, L.—Flowers smaller than the preceding; four to six pairs of acute leaflets; long, linear pods.

177. CASSIA TORA, L. (*C. obtusifolia, L.*)—Leaflets, two or three pairs, obtuse; pods six inches long.

178. CASSIA CHAMAECRISTA, L.—Stems spreading; flower, large, axillary; leaflets, ten to fifteen pairs, slightly sensitive.

178a. CASSIA NICTITANS, L.—Flowers very small; leaflets, ten to twenty pairs and sensitive, closing almost instantly.

The first and fourth of these are common in this vicinity, but the other three have as yet only an uncertain tenure, and can be considered only as waifs and strays.

ROSACEÆ.

193a. Potentilla recta, Willd.—This species has been found only within a few days growing in Eden Park by Miss Sarah C. Stubbs. It is a strong growing species, two or three feet high, with five to seven cut-serrate leaflets, and large light yellow flowers. It is by far the handsomest Potentilla yet found here.

HAMAMELACEÆ.

219a. Liquidambar Styraciflua, L.—Sweet Gum. A quite hardy tree, planted by the late Dr. John A. Warder, at North Bend, O. It has been observed in the woods near Mt. Healthy by Mr. Morgan. It grows abundantly throughout Kentucky.

HALORAGEÆ.

220. Myriophyllum.—There are four species of this genus given in the catalogue on the authority of Mr. Clark. None have, as far as is known, been identified here of late years. They should be looked for in ponds and pools. An investigation of the canal basin near the Work-house, and of Ross Lake, would perhaps add to our knowledge of them. Other water plants, too, are likely to be discovered in these places.

ONAGRACEÆ.

232a. Jussiæa leptocarpa, Nuttall.—This species is a strictly southern one, and was found on a floating log at the mouth of the Licking River by Mr. Lloyd. The following is the description, taken from Chapman's Flora of the Southern States, page 140:

"Hairy; stem erect, at length much branched; leaves lanceolate: acute; flowers small; calyx lobes mostly six, as long as the petals; capsule linear, cylindrical, much longer than the pedicel. Marshes, Florida and westward, June, September. Stem, two feet to five feet high; capsule, one and a half inches long, slightly curved."

It is to be hoped that this species will be found again. At present, however, it can not be claimed as belonging to our permanent flora.

UMBELLIFERÆ.

243. Caucalis anthriscus, Huds.—First discovered by Mr. C. G. Lloyd at Mt. Lookout, it has since been found by others, and is becoming thoroughly naturalized. It is supposed that it was first introduced with some imported cattle of Mr. Kilgour's. It cannot be considered a desirable addition to our flora. As the species is not noticed in any of our

botanical manuals the description is inserted below. (Hooker's Students Flora of British Islands, pp. 179–180.)

"CAUCALIS, L.—Annual, hispid herbs; leaves, 1–3 pinnate; umbels compound, terminal or leaf-opposed, usually of few rays sometimes bracts few or none; bracteoles more numerous; flowers, white or purplish, polygamous, outer often rayed; calyx teeth acute or none; petals often unequal, the larger notched, point inflexed; disk lobes, thick, conical; fruit, ovoid or oblong, constricted at the commissure; carpophore undivided or 2–fid; carpels sub-terete, ridges with one or two series of spines; vittae solitary in each secondary ridge; seed deeply grooved ventrally.

"C. ANTHRISCUS, Hudson.—Leaves, 1–2 pinnate; leaflets, broad; umbels, terminal, compound; bracts, 4–6; spines of fruit, incurved, not hooked. . . . . . . Hispid more or less; stem erect, branched, solid, striate; hairs reflexed; leaflets many, close set, one-fourth to one-third inches, pinnatifid or lobed; umbels, 5–12-rayed; bracts, small subulate; flowers, minnute, white or pink, outer pedi celed, fertile; fruit, one-eighth inch, ovoid; styles short, straight."

244. HERACLEUM LANATUM, Michx.—Credited to Mr. Lea's catalogue, but found this year at Cumminsville by Mr Going. It has a very large umbel of greenish-white flowers, very large leaves and is very rank and coarse in growth.

253. CICUTA BULBIFERA, L.—Credited to Mr. Clark in the catalogue; was found near Ludlow Grove during 1883 by Mr. Spurlock. It grows abundantly in wet places. It is easily distinguished from *C. maculata*, by its linear leaflets, and the presence of numerous bulblets in the axils of the leaves.

ARALIACEÆ.

261. ARALIA SPINOSA, L., Hercules Club, etc.—This is not a common plant in this vicinity, but is a striking one in appearance. It grows fifteen or twenty feet high, with the slender trunk covered with prickles. The large compound leaves spread out in a cluster near the top of the stem.

COMPOSITÆ.

310a. ASTER LONGIFOLIOUS, Lam.—Very common in places along the Little Miami River at Loveland, O.

339. XANTHIUM SPINOSUM, L.—Quite common along roads back of Covington, but never yet found on this side of the river.

347. LEPACHYS is now considered a synonym of RUDBECKIA.

362a. Coreopsis trichosperma, Michx.—Found by the Misses Mohr near Burnet Woods; afterwards by Mr. Spurlock on the canal near the Work-house. This is a very western station, as it is mostly confined to the coast. It is easily recognized by its finely dissected leaves and bright yellow flowers.

370a. Matricaria discoidea, DC.—This has been found near Loveland, O., in one spot, and was doubtless introduced with some plants from California. It has previously been recorded from only one or two localities in the eastern section of the country.

371. Leucanthemum vulgare, Lam., Ox-eye Daisy.—Is now referred back by Bentham & Hooker to the old name of Chrysanthemum Leucanthemum, L.

392. Lappa officinalis, Allione, is now called Arctium Major, L.

392a. Cichorium Intybus, L.—Cichory. Found by the Misses Mohr on Elm Street Hill, apparently well established. The flowers are quite large, bright blue, leaves minute and inconspicuous.

LOBELIACEÆ.

410. Lobelia spicata, Lam.—This has been credited to Clark's catalogue, but three or four spe imens were found last year by the writer near Branch Hill, O.

CAMPANULACEÆ.

412. Specularia Americana, Morgan (*Campanula Americana, L*).—This common species is, I believe, a true *Specularia*. Wh le all the genuine Campanulas have bell-shaped, drooping, pediceled flowers, the species of Specularia have rotate, erect and sessile flowers. These last points are found in the *C. Americana*. In Hooker's Students' Flora of the Brit-Islands, *Specularia* is a sub-genus under *Campanula*. In the Genera Plantarum they are kept distinct. As Mr. A P. Morgan first suggested the change here given, he is credited with the new name.

412a. Campanula rapunculoides, L.—Found by the Misses Mohr on Elm Street Hill. Escaped and naturalized.

ERICACEÆ.

415. Monotropa uniflora, L.—A large bunch of plants of this species was exhibited before this Society on October 3, 1882. An examination of the cluster to see if any indication of parasitism could be found, revealed no connection between its mass of roots and those of the trees among which it grew. The mass resembled more the mycelium of a fun-

gus than true roots, and the conclusion reached was, that at that period of its life, at least, the plant drew its nourishment from the decaying vegetable matter among which it grew. Whether during a previous period the roots were connected with those of trees could not be ascertained, but all appearances were against such connection. (See Vick's Monthly Magazine, vol. v., p. 330–332.)

BIGNONIACEÆ.

430a. CATALPA SPECIOSA, Engelm.—First brought into notice by the late Dr. J. A. Warder, and by him considered a valuable tree for building and other purposes. The following is the description from *Botanical Gazette*, vol. v., p. 1:

"A middle-sized tree, with grayish brown, much cracked or furrowed, at last slightly flaky bark, and light yellowish gray wood; leaves large, truncated or more or less cordate at base, slightly acuminate, soft, downy on the under side, inodorous; flowers in large and loose panicles; tube of the corolla conical, longer than wide, its lower part scarcely protracted; upper lip before its expansion longer than the other lobes and enveloping them; lower lobe bi-lobed; inside of the corolla slightly marked at the throat with red-brown lines, and with two yellow bands at the commissures of the lowest with the lateral lobes; stamens and style as long as the tube, pod terete, strongly furrowed; wings of the seed about as long as the seed itself, rounded at the ends and split into a broad coma."

LABIATEÆ.

471a. TRICHOSTEMA DICHOTOMUM, L.—Found during 1883 on the Ohio River bank. A very much branched herb, with small flowers, and similar in habit of growth to *Isanthus caeruleus*, Michx.

CONVOLVULACEÆ.

533. CONVOLVULUS ARVENSIS, L.—Found by Mr. Spurlock and Mr. Going.

535a. JACQUEMONTIA TAMNIFOLIA, Griseb.—A few specimens of this species, native much further south, were found by Mr. C. B. Going at the Stock Yards on the C. W. & B. R. R. The description is appended. The plant can be considered as only a waif, and may or may not be found again.

"JACQUEMONTIA, Choisey.—A rather small genus, tropical or subtropical, mostly with the aspect of Convolvulus.

"J. TAMNIFOLIA, Griesb.—Erect or at length twining, fulvous-hirsute; root annual; leaves cordate and ovate, long petioled, pinnately veiny;

peduncles elongated, capitately many flowered; glomerate cluster involucrate with foliaceous bracts; sepals subulate linear, ferruginous-hirsute, 5 lines long, nearly equaling the violet corolla. Cult. and waste grounds, from South Carolina and Arkansas southward." (Gray Syn. Flo. N. Am., vol. ii, part 1, p. 214.) Chapman under *Ipomoea tamnifolia,* adds, "Capsule depressed, somewhat four-sided."

SOLANACEÆ.

540a. PHYSALIS PHILADELPHICA, Lam.—Quite common at Loveland, O. Identified during the past summer (1883).

546. DATURA METELOIDES, D C.—This seems to be the species formerly given in the catalogue as "*D. metel*, Locke." It is cultivated in old gardens and may have escaped to roadsides in some places. The principal characters of the species are as follows: Puberulent or pubescent; leaves ovate, entire or repand-toothed; corolla six to eight inches long, white or tinged with violet, sweet scented. Native along streams in Texas to Arizona and California. Chapman considers *metel* as a good species, but it is probably only a synonym.

546a. NICOTIANA TABACUM, L.—As this species is being largely cultivated in this vicinity it is likely to escape and be found along roadsides. It is easily known by the exceedingly large leaves and tall spike of tubular, pinkish flowers.

EUPHORBIACEÆ.

616a. EUPHORBIA CYPARISSIAS, L.—Growing abundantly on a private place near Loveland, O., and escaped from cultivation.

LEMNACEÆ.

678. LEMNA MINOR, L.—Given in the catalogue on the authority of Mr. Clark. It has recently (June 1884) been rediscovered at Cumminsville by Mr. Going.

NAIADACEÆ.

684. ZANNICHELLIA PALUSTRIS, L.—This species credited to Mr. Lea has been lately found by Mr. Going in the same locality as *Lemna minor*. There are, doubtless, many species of *Potamogeton* in our streams also.

TYPHACEÆ.

682a. SPARGANIUM SIMPLEX, Hudson.—Chester Park. Dr. R M. Byrnes.

ORCHIDACEÆ.

696. SPIRANTHES CERNUA, Richard.—A single specimen of this was

found September 17, 1882, by Mr. D. L. James near Loveland. It had not before been identified here since Clark's list was published.

IRIDACEÆ.

707. IRIS VERSICOLOR, L.—This was found this year at Chester Park, by Mr. Going. Before credited to Mr. Clark, it is thus rediscovered. Dr. R. M. Byrnes has found it in Mount Lookout woods and at Batavia Junction, on the L. M. R. R.

CYPERACEÆ.

783. CAREX CRINITA, Lam.—This was credited to Lea's catalogue, but has lately been found by Mr. Going near Glendale. The Carices of this vicinity have not been very industriously collected, and a little attention would doubtless add many species to the list.

GRAMINEÆ.

846a. LOLIUM PERENNE, L.—This species, a new one to the flora, was found in Avondale by Mr. D. L. James.

851a. AVENA STRIATA, Michx.—A new species to the flora; and found by Dr. R. M. Byrnes.

854a. PHALARIS CANARIENSIS, L. (Canary Grass.)—Found frequently about houses and on rubbish heaps.

858a. PANICUM VIRGATUM, L.—Was found by Mr. Spurlock near Sedamsville. It grows from three to five feet high, and has a very long panicle of flowers.

859. PANICUM LATIFOLUIM, L.—D. L. James.

861. PANICUM DICHOTOMUM, Muhl.—D. L. James.

862. PANICUM DEPAUPERATUM, Muhl.—D. L. James.

865. CENCHRUS TRIBULOIDES, L.—Hedgehog or bur-grass. "A vile weed" (Gray). Introduced and growing abundantly along the O. & M. R. R., near Riverside. Easily recognized by the spiny fruit.

EQUISETACEÆ.

874. EQUISETUM HYEMALE, L.—Miss Marie Mohr.

FILICES.

875. POLYPODIUM INCANUM, L.—This species was found in a single locality a few years since by Drs. Byrnes and Langdon, and has lately been observed by the writer. Specimens were collected from a partially dead tree near Batavia Junction, on the L. M. R. R. It is very rare in this region.

OPHIOGLOSSACEÆ.

897. Boytrychium ternatum, Swartz.—Mr. S. T. Carley furnishes the following information regarding this species: The frond makes its appearance in July, and the fertile part soon matures; the sterile portion persists till within a month of the time for the new frond to appear. In winter it is copper red, and in the spring changes to the original green of the young frond.

CHARACEÆ.

899a. Chara coronata, Ziz.—This appeared in a tub of water-lilies near Loveland. The interesting genus, of which there are many species in the United States, has not been studied in our section. The canal basin near the Work-house, Ross Lake and similar places, will probably yield several species.

NORTH AMERICAN LEPORIDÆ.

By Charles Dury.

(Read and referred March 4, 1884).

There are more species of true hares in the mammalian fauna of North America, than in any other country in the world. Our twenty-two species and varieties are pretty evenly distributed over the entire area of the country, from the Great Lakes to Florida, and from Maine to California. They are commonly called "rabbits." But the fact is, we have no rabbit indigenous. All are true hares. The rabbits of this country are introduced animals and are varieties of the European *Lepus Cuniculus*, which differs from the hares in its shorter hind legs and other features of the bony structure, as well as its different habits. In London, last summer, in visiting some animal dealers' shops, I was amazed at the differences in color and form of the domesticated rabbits offered for sale. There were white, black, grey, ash, yellow, buff, and all sorts of combination of these colors. In shape these were long, short, thick and thin. Some varieties had the hair short and in others it was long and silky, but the most astonishing freak of this artificial selection was the enormous lop-eared varieties. Some of these exceeded the largest known hare in size, and with a length of ear that would make our so-called "jackass rabbit" ashamed of its accomplishments in this direction. The ash or buff-colored giants have been brought from the little grey, short-eared *Lepus Cunicu'us* by artificial selection, within a short period. Artificial selection has accomplished more with the domesticated races of the genus *Lepus* than natural

selection has done with the wild ones. The true rabbit, in its wild state, lives in burrows in the ground, which it excavates, and into which it retreats for safety at the approach of danger. In these burrows the young are brought forth blind and helpless, while the hares bring forth the young on the surface of the ground and make the nest in a depression which they line with hair plucked from their own bodies. The rabbit is nocturnal in its habits, passing the day in its burrow, and issuing forth in the evening to feed. In England a collection of rabbit burrows is called a "warren," and in some of them there are thousands of individuals. They are hunted with "ferrets," a small animal allied to our weasel." The "ferret" is muzzled to prevent its capturing a rabbit in the burrow, for if it was not muzzled it would secure a victim, bite into its throat and gorge itself with blood and then go to sleep in the rabbit's nest, leaving the anxious hunter waiting at the mouth of the burrow for a chance to get a shot. There is nothing the English rabbit is so afraid of as a "ferret." When one enters a burrow there is a pell-mell rush to get away, and all the inhabitants of the group of invaded burrows scamper up and out of the nearest entrance, and off to other and more distant holes. Then the hunters blaze away right and left. Sometimes many rabbits are killed, but frequently in the excitement all get away. When the "ferret" has run them all out he comes walking leisurely out himself with a disgusted look on his grim visage. He is then taken by the gamekeeper, and, after the gentlemen are stationed at another suitable group of holes, the "ferret" is started in again and the fusilade is repeated. The poachers take advantage of the rabbit's dislike to "ferrets" and stop up all holes but two or three and start in the "ferret." Over the open holes they hold large bags, the rabbits rush into the bags until they are full; they will go into a bag or anywhere to escape the dreaded "ferret." The "ferrets" are trained for the purpose and rewarded for the part they take in this wholesale murder by a repast of blood when the battle is over. The fecundity of the rabbit is very great, the progeny of a pair in a few years amounting to thousands. Redfield says, "twelve litters of young are produced in a year by the English species, and were it not for their numerous enemies they would be a calamity.

The hare does not depend on a shelter of any kind for safety, but trusts to its fleetness of foot to escape from its enemies. Our familiar species *Lepus Sylvaticus*, the "sylvan hare" or "cotton tail" as the boys call it, will sometimes, when the weather is bad and snow is deep, go into a drain pipe or hole, but it can move away from a dog at a pretty good gait. But its best speed is not a circumstance to the way its long-eared cousin,

the "jackass rabbit," (*Lepus Callotis*) can climb over the ground when it tries. Ever since I read Mark Twain's account of this animal I wanted to make its acquaintance, and when in Southern New Mexico I was gratified. I did not see any until I reached the Mesilla Valley, but there they were abundant, but very difficult to shoot, as they ran away so quickly it was almost impossible to stop them. I only got a few by accident; the speciman exhibited ran past where I was hid in some mesquite bushes. I banged a charge of No. 8 shot broadside into him. When I went down to him, his sad, yellow-brown eyes bulged out a quarter inch, filled with reproach, (and sand) seemed to say: "How could you be guilty of so cowardly an act as that?" He was going as if he had forgotten something and when the shot hit him he could not stop long enough to die, but went fifty or sixty feet down the hill head over heels. Mark Twain says of the speed of this animal, "But one must shoot at the creature once if he wishes to see him throw his heart into his heels, and do the best he knows how. He is frightened clear through now, and he lays his long ears down on his back and straightens himself out like a yard stick every spring he makes, and scatters miles behind him with an easy indifference that is enchanting. Our party made this specimen hump himself, as the conductor said. The Secretary started him with a shot from the colt, I commenced spitting at him with my weapon and all in the same instant the old allen's whole broadside let go with a rattling crash, and it is not putting it too strong to say the rabbit was frantic; he dropped his ears, set up his tail and left for San Francisco at a speed that can only be described as a flash and a vanish; long after he was out of sight, we could hear him "whiz!" It was likely the "prairie hare" he alludes to, as it is the species in the country he was in. The true "jackass rabbit" can play all around this animal in running if he tries.

Two *Lepus Callotis* and several *Lepus Sylvaticus* confined together in an inclosure at the Zoological Garden, fought in a desperate manner, both of the *Lepus Callotis* were killed outright, the fur being almost stripped from their backs. The little hares attacked them with their fore-feet. *Lepus Sylvaticus* will fight with great fury among themselves, making the hair fly in every direction.

Our hare *Lepus Sylvaticus* is attacked by a large fly, called *Cutrebra Cuniculi*, which lays an egg in its back; this egg hatches into a larvæ that burrows under the skin and makes a sort of pocket in which it lives and sucks nourishment from the animal. I exhibit a specimen taken from the back of a hare; the animal was emaciated and weak. This larvæ is nearly full fed and is much shrunken from drying; so you can imagine

what a delightful counter-irritation it must have produced. The cry of this hare is seldom heard, yet it can scream like an infant in distress. I never but twice heard it—once when I reached into a pile of cordwood and caught hold of the hind legs of one that had squeezed in between the sticks. In pulling it out its skin was torn, and it yelled vigorously. I was so surprised at this, I let go my hold and the hare ran away like a streak. The hare can run with its hind legs tied together. Some German hunters, near Glendale, had caught one in a stone-pile, and when they stopped for lunch, one of their number tied its hind legs together with his red silk handkerchief. No sooner had he laid the animal on the ground than away it dashed, taking the pocket-handkerchief with it, and though the owner of the bandanna yelled, "Skoot him, Skoot him," his friends, who had laid down their guns were too paralyzed with astonishment to shoot, and the visions of "hasenpfeffer" vanished with the handkerchief. I may add the disinterested spectators in the vicinity smiled audibly.

The "prairie hare" (*Lepus Campestris*) from Kansas and Colorado is called "jackass rabbit" in Kansas, and "snowshoe rabbit" in Colorado; it is a very different animal however from *Lepus Callotis*, and turns nearly pure white in winter. The specimen exhibited of this hare, is in the autumnal pelage. One of the smallest of the North American hares is the "little sage hare," (*Lepus Nuttalii*) found in the West, from Nevada down to Texas. The speciman exhibited is from New Mexico, and killed near where the *Lepus Callotis* was taken. Mr J. A. Allen has decided this to be but a diminutive race of our sylvan hare and calles it *Lepus Sy vaticus var Nuttalii.* They feed on the leaves of the sage and grease-wood, and if the intestines are allowed to remain in the abdominal cavity after death, even as long as thirty minutes, the flavor goes all through the flesh and renders it so bitter as to be uneatable, but if they be immediately drawn they are good eating. I found the jackass fellows tough, stringy and tasteless, but waxed fat on the little ones, which I broiled in front of the fire with festoons of pork wrapped around them. The only animal that can catch the "jackass hare" is the greyhound and they can only do it under favorable circumstances. I measured, by the tracks in the sand, some of the down-hill leaps made by one of these hares and found them to be over twelve feet.

The hare crouches all day in its "form," which is a place in a tuft of grass or weeds, hollowed out just the size of its body. In this position it is always ready to spring out and away. When started from its "form" it never goes back to the same one, but makes another; but if undisturbed it uses the same one more than once. The white hare exhibited, is (*Lepus*

Americana) in the winter pelage ; it is of a rich brown and grey coat in summer. This species occurs in New York, Michigan, Pennsylvania, Canada, Minnesota, and perhaps in the northeastern part of Ohio. It is a fair table species.

The largest hare we have is the "polar hare," (*Lepus timidus var borealis*), which occurs in Dakota, Washington Territory and the Hudson Bay Company's possessions. It is the largest species in the world and identical with the hare of Ireland, England and Scotland. It is white in winter and brown in summer, and completely mimics its surroundings.

A very interesting species is the "water hare," (*Lepus Aquaticus*), a species with an enormous head. It takes to the water to elude its enemies and swims with great speed and ease; it also goes into the water and swims about. feeding on the tender shoots of aquatic plants of which it is very fond. Its flesh is worthless as food. It occurs in South Illinois, Kentucky, Tennessee, Georgia, Alabama, etc.

The marsh or swamp hare, (*Lepus Palustris*) has about the same range, but lives in the dense thickets and canebrakes on the edges of the water ; both of these species are great desiderata in many collections.

Lepus Bairdii or "Baird's hare," found in the Rocky Mountain region, is perhaps more remarkable than any, from the fact that the male has the mammalary glands fully developed, and assists the female in suckling the young. A case without a parallel I believe in nature. Mr. John M. Murphy gives an interesting account of this in his work on the "Game in the Far West," published by a house in London, and authenticates it by statement of the surgeon who dissected the animals.

Lagomys is a genus of rodents allied to the hares, which includes four species : one in the northern mountains of Europe, one in Mongolian Tartary, one in southeastern Russia and one in the Rocky Mountains of the United States. Ours is called the "little chief hare" (*Lagomys princeps*). They lay up a store of food for winter use and their cry is like the bleat of a sheep.

Six species of extinct hares have been described from the Miocene deposits of Dakota and Colorado. They are about the same size as existing species and belong to the Genera ,

Palæolagus, *Panolax*, and *Praotherium.*

Let us return thanks that the zoological "hair splitters" have not been able to subdivide the genus *Lepus* up into eleven genera, each one to take in a species and its varieties. They can do it with the fossil species, as perhaps the genus is founded on a broken tooth or the head of a broken rib, and one or two collections contain all the pieces ever collected.

In concluding, I tabulate the hares somewhat according to size as follows, beginning with the largest:

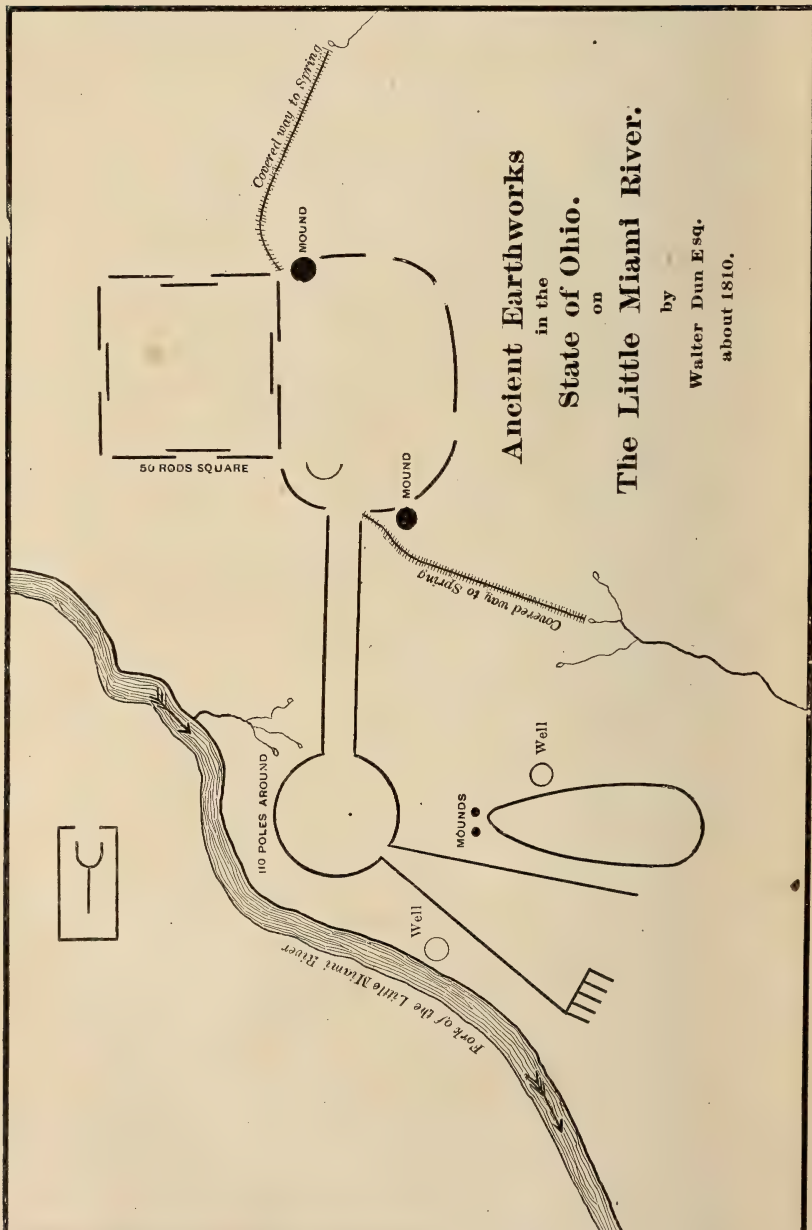
1. *Lepus tunidus.*
   " " *var Arcticus.*
2. *Lepus Callotis.*
   " " *var Callotis.*
   " " " *Texanus.*
3. *Lepus Campestris.*
4. *Lepus Californicus.*
5. *Lepus Aquaticus.*
6. *Lepus Americanus*
   " " *var Americanus.*
   " " " *Virginiensis.*
   " " " *Washingtonii.*
   " " " *Bairdii.*
7. *Lepus Palustris.*
8. *Lepus Sylvaticus.*
   var Nuttalli.
   " *Auduboni.*
   " *Arizonæ.*
9. *Lepus Brasiliensis.*
10. *Lepus Graysonii.*
11. *Lepus Trowbridgi.*

ANCIENT EARTH-WORKS IN THE STATE OF OHIO, ON THE LITTLE MIAMI RIVER.

By Walter A. Dun, M. D.

Dec. 4, 1883.

It is my pleasant task to-night to communicate to this Society some of the earliest plans of those interesting earth-work remains situated on the Little Miami River. The plans which I now have the pleasure to lay before you were found by me while delving among some old family papers. They are the rude drawings of a surveyor, taken on the field, and I regret to say that so far I have been unable to recover the notes which evidently go with them. They are the work of my grandfather, Walter Dun, Esq., who died at Lexington, Ky., in 1838. The date of these plans is uncertain. From 1806 to 1838 my grandfather was an active surveyor in the Virginia Military Land District. Yet the fact that these plans are not


Ancient Earthworks
in the
State of Ohio.
on
The Little Miami River.
by
Walter Dun Esq.
about 1810.
50 RODS SQUARE
MOUND
MOUND
Covered way to Spring
Covered way to Spring
110 POLES AROUND
MOUNDS
Well
Well
Fork of the Little Miami River

more distinctly designated by roads, counties or other landmarks inclines me to the belief that they were among his early labors, and probably date back at least to 1810.

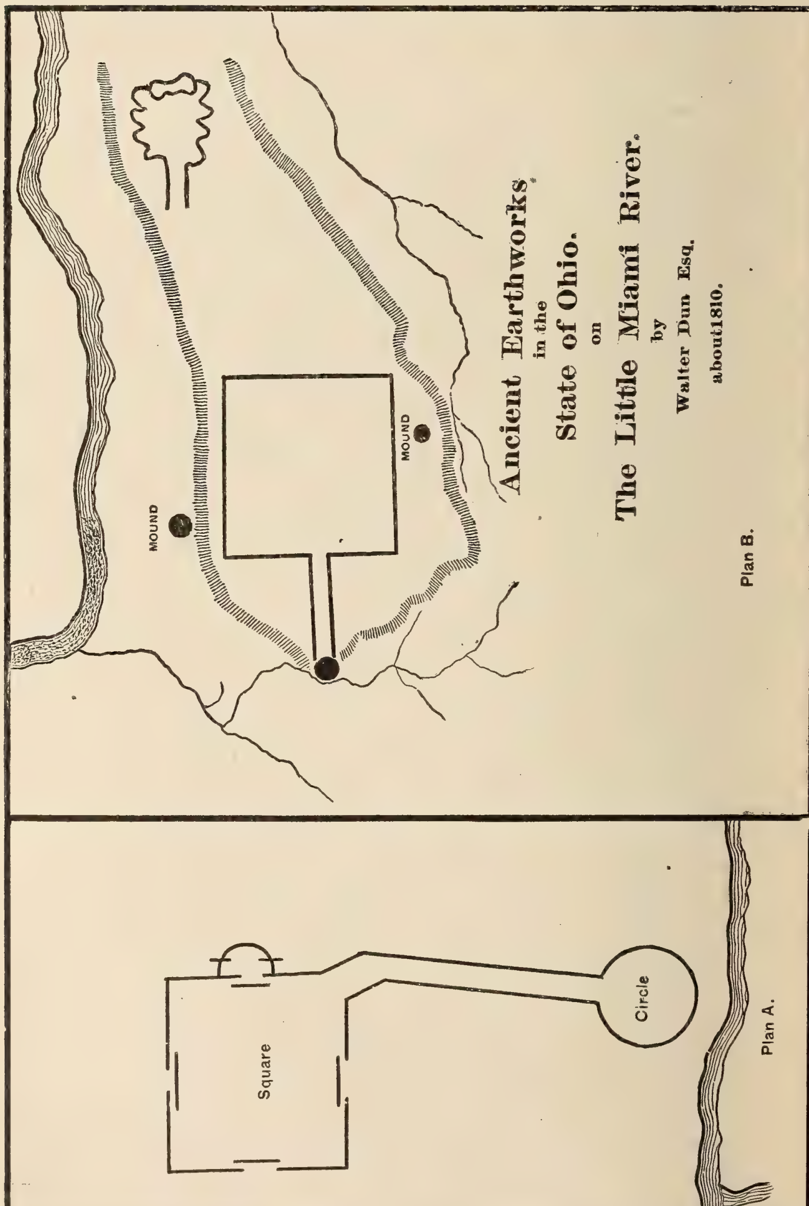
Walter Dun, my grandfather, was educated at the University of Glasgow, and struck, no doubt, by the peculiar conformation of these structures, made these plans and took other notes on the ground, which afterward were made into other and better plans in his office, and no doubt formed the material for a communication to his old University at Glasgow.

Two of the plans, with a third supplementary plan, are perhaps now presented for the first time to a scientific society in this country. Their exact location is not known, except that they are on the Little Miami River, and are probably not far removed from the other plans, which are of works near Milford, in Clermont Co., Ohio. The other plans are identified as the same as Nos. 1 and 2 of Plat 34, Vol. 1, Smithsonian Contributions to Knowledge, by Squier and Davis, 1847. The first plate is interesting in a double sense. Although the rough drawings of a surveyor on the field it corresponds pretty accurately in the measurements given by Davis in 1847. It is far more interesting from the fact that it notes and locates much more of the surrounding works and details of the work itself than is to be found in the survey of Davis. This may be accounted for in two ways. Either these had disappeared from view under the plow in the time which intervened between the surveys, or they escaped the observation of Davis. I can vouch for the utmost correctness of these rude plans, and base it entirely upon the character of the man and the fact that he was a most accomplished and accurate surveyor. Gen. Lytle, of Cincinnati, made a survey of this same work, which was published in Warden's Appendix to Du Paix's Antiquities of Mexico.*

The second plan, which appears in (Vol. I, Ibid) is taken from Warden's Adpendix above mentioned, where it appears from a survey of Gen. Lytle. Squier and Davis never saw it, and do not vouch for the details of the plan which so nearly resembles the plan which I now exhibit and which is certainly older than that of Gen. Lytle.

These plans are not only interesting from a historical point of view, but also from the interest which these ancient monuments excited in the educated pioneers of Ohio, which in this case prompted these plans, and which in one of these, at least, adds additional interest and value in the greater details shown, which have probably been eradicated by the plow. Then, too, they belong to the region near the cemetery and its adjoining mounds

* Vol I, S. Cont. Knowledge. Page 95.


Ancient Earthworks in the State of Ohio. on The Little Miami River. by Walter Dun Esq. about1810.
MOUND
MOUND
Plan B.
Square
Circle
Plan A.

so recently the subjects of investigation by an extinct society with a long name and a learned Eastern professor. I can not close these few sheets without making an earnest appeal to this Society to *at least* raise its voice and demand of the new Legislature an appropriation for the accurate and complete survey and investigation of these mounds and earthworks. I would like to raise voice against the destruction of these remains, but well know the uselessness of it; and, since they can not be preserved in tact, a good survey is the next best thing, and an investigation and collection of their relics in some museum, where they are not indiscriminately scattered, would greatly aid students of this department and redound to the credit of the State and its people.

SWISS LAKE DWELLERS.

By Walter A. Dun, M. D.

While traveling in Switzerland in the summer of 1882 I secured these relics of the ancient Swiss Lake Dwellers, and am glad I have this opportunity to submit them for your inspection.

They came from the dredging operations in making the quay at the city of Zürich, situated at the lower end of that long narrow Züricher See and at the point where it is drained by the river Limmat. This body of lake water, some twenty-five miles long and two or three broad, situated at the beginning of the northern spurs of the Alps and extending at its southern point between its rugged mountains, is peculiarly interesting as the lake in which the first remains of the Lake Dwellers were discovered in 1854.

I understand that before my return from Europe our worthy Custodian presented to this Society a paper on this subject, so that I will confine myself to a few interesting observations which I made on the scenes of the dwellings of these people. A rapid glance at the various lakes in Teutonic Switzerland, where these remains are most abundant, will show in the main that their general trend is north and south and that the southern portions are surrounded by rugged Alpine crags, while the northern banks extend into low plains gradually ending in bogs of peat, or at any rate lowlands and valleys from which outlets lead to the sea. When viewed from some commanding eminence, as the Uetliberg or Rigi Kuhn, the shallow points or tracts of water are very perceptible by a beautiful light bluish color. The lakes of Lucerne, of Zug and of Zürich show all the points I have alluded to, and being in the trodden path of tourists and travelers, can not escape observation. It is along the portions of those lakes, where a low level country surrounds and where the water is shallow, that the

Lake Dwellers were most numerous. It may have been their nature to build in the water, yet it seems far more probable to me that the peculiar remains of cities or towns built over the water on piles were due to the fact that the people merely adapted themselves to the circumstances of their surroundings. At the present time scattered along the banks of these lakes, and especially to be seen on the lake of Zug, are many houses of the present Teutonic Swiss peasants, which project over and incroach upon the lake waters. The area of arable land being small, it is used for agricultural purposes, and a dwelling built over the waters of the lake is so much space gained. Then, too, the means of communication being by water, the house subserves the triple purpose of dwelling, storehouse for exports, and boat house. Any one with slight experience in boating must know how nasty it is to land a boat in shallow water with a low boggy bank. It would be among the first natural impulses to avoid a repetition of such semi-wading, miry experiences, and this was no doubt easily accomplished by a pier of logs, which, being constructed and improved upon and extended as time passed, gave the initial start to the architecture of pile construction. The farther this pier was extended into the lake the deeper the water, so larger boats with heavier draft could approach and unload. This must have considerably increased the labor of carrying these articles ashore, and eventually have led to the building of a storehouse at the end of the pier, and thus the first house was built over water, and around it would naturally cluster, as time passed, other houses for occupants, which would eventuate in a lake dwelling settlement. Then, of course, as soon as each house could be approached by all classes of boats, the necessity of a general supply from a storehouse would disappear and the storehouse be converted into other purposes. Other advantages were undoubtedly derived from this mode of living. The excrement of men and animals was disposed of in the lake, thereby avoiding much danger, for we know that the two great diluents and oxidizing agents for noxious matter are air and water. The offal from eating also no doubt attracted and fed quantities of fish, of which we are certain, judging from the remains of nets and hooks, these ancient people fully availed themselves.

The purpose of defense I believe to be entirely one of secondary consideration Dr. Daniel Wilson splendidly defined man when he said, "He is the fire using animal." We find no prehistoric remains so extensive or numerous in Switzerland as those of the lake dwellers. Are we then to believe that their pile towns have defended them from barbarians less civilized and less numerous than themselves? In defending themselves from tribes of similar lake dwellers they would have been worse in these dwel-

lings than on land, for being of wood built on water they would have been more easy of approach by boats and set on fire, for example, at night, leaving the way for retreat open. There is no agency so powerful in war for havoc, devastation and panic as fire, and to tribes of lake dwellers these villages would have been an easy prey. It is true that we have evidences of the burning and rebuilding of these towns, yet it has been attributed to accident rather than the horrors of war. It is further true that had they been compelled to fight a barbaric land enemy of great strength we would have looked for them to fortify some of the commanding eminences about the lake, since they were an industrious people. Based, then, entirely upon these few facts, I think that if they ever acted a part in defense it was chance and a secondary part to their original conception and purpose. There are a few other interesting facts about these people. They were Asiatic in origin, as numerous bones of their domestic animals,viz.: the cow, horse, sheep, hog, etc., which are of Asiatic origin, attest. They were a people who, while engaged in fishing, hunting and war, yet were in quite a degree agricultural, and, more than that, cultivated their grain with skill. They had apples, ground nuts, wheat, etc., showing considerable degree of cultivation. They are peculiar as representing in some settlements stone relics alone, while in later settlements implements of copper and bronze occur. We often hear of the ages of stone, copper, bronze, iron and steel, but these are indefinite phrases; we have no ages, they are merged gradually one into the other. We call ourselves the age of steel, and still you find stone, copper, bronze and iron used; and just so all ages after the *stone* age are combinations to which time has added the others. The lake dwellers, then, in their earlier periods, used only implements of stone, later they began the use of copper and bronze, which in a measure superceded the stone and materially enhanced their progress.

This advance of a rude people may well be likened to the foundation of a house in which each course of stone is necessary and also prepares the way for the one to follow. Each course must have its beginning, gradually cover over the previous one, to be covered itself in its turn. Just so is it with this subject of ages. Each, like a course of stone or brick in a foundation, must have its beginning. It is laid in the mortar of a previous age, which it does not suddenly blot out, but gradually covers and supersedes, leaving a small space uncovered. Thus, at the beginning of the age of bronze, that article was rare; gradually it became more plentiful and superseded stone in the exact proportion as it became more plentiful, and so on it has been with those ages that follow. Perhaps the most interesting point connected with this curious people lies in a consideration of their

relative age and their relation to history. There is no doubt that the remains of those older settlements, where stone implements alone were used, are of very great age, and of them we have no record and no history, except what is deduced from their silent remains. In some of the latter settlements, however, there appears undoubted relics of Roman origin, which links them to the dawn of history and reveals them to us as the celtic tribes of Helvetia described in Cæsar's Gallic Wars. Numerous references are to be found among ancient Greek and Roman authors describing the lake-dwelling nature of this people, and it is probable that part of their progress in the art of metallurgy was derived from intercourse with the more advanced Greeks, Romans, Phœnicians or Carthagenians, who traversed and settled the regions bordering upon the Mediterranean Sea.

The peculiar nature of building houses upon piles is not only manifested in the instance referred to in some of the Swiss peasants of to-day, but it also has an example in the city of Venice, founded and built upon piles by the Venetian tribes of fishermen. This city, once the grandest in the world, is fast falling to decay. The piles which support that grand structure, St. Mark's Cathedral, are gradually giving way and the floors of those beautiful mosaics are sinking. Yes, Venice is strangely built upon piles imbedded in the mud of low islands and shallow seas, and is an ideal representation of what the residence of the lake dwellers might have been expected to develop into in modern times under the influence of art, affluence and power combined with the advances of civilization.

I will detain you only for a summary of these points. These people were of Asiatic origin, a part of the first great wave of Aryan people, viz.: the Celtic. They had advanced beyond the hunter period before leaving Asia, and had become a nomadic pastoral people with their herds of domesticated animals; reaching Switzerland, into which they were crowded by later waves, they found some difficulty in this nomadic, pastoral life from the rugged nature of the country. The lakes abounded in fish, while their level shores were fertile. Under these influences they could but adapt themselves to circumstances, and so they began to be an agricultural people, retaining their hunting and fishing proclivities and also their stock. Circumstances, which I have before described, eventually led to their dwelling in lakes. We have also in these people the link which connects the people who used stone relics with the history of the Romans, and which are thus connected with modern times, as well as examples of the introduction of copper and bronze. Recent discoveries in the lakes and bogs of Scotland and Ireland would seem to indicate that the celtic inhabitants of those countries had similar proclivities. Yet, with this important difference,

in Switzerland they built on piles, while in Ireland and Scotland they built on low islands; on the other hand, in Venice they built on both piles and islands. The tracings of the philologist of this celtic people by means of their language and their stories from Asia, as a wave of the great Aryan race, have received additional confirmation by the discovery of bones of the domesticated animals from Asia among their remains. This brief sketch, only intended to embrace a few points, I hope will be accepted by you as such.

NOTES ON COLEOPTERA, WITH ADDITIONS TO THE LIST OF THE COLEOPTERA OF CINCINNATI.

By Charles Dury.

(Read and referred July 1, 1884.)

Adranes Le Contei.

While searching for rare beetles near Avondale recently, I turned over a small beech log, partly decayed, that was honey-combed by a medium-sized pale brown species of ant. On being disturbed, the ants rushed about in great confusion; among them I recognized several *Adranes Le Contei*, a small beetle belonging to the family *Pslaphidæ*. *Adranes* is one of the most remarkable beetles known, both in habits and structure; it has a minimum number of joints in the antennæ—there being but two, the usual number in the Coleoptera being about eleven, while in some of the Longicorns there are twenty-seven. The eyes are entirely wanting, as in some of the beetles found in caves; the abdominal segments are connate. The species is quite rare in collections, and has never been recorded before from this locality.

On each side of the body and just back of the elytra is a tuft of brown hair, and from it springs a tube from which the beetle exudes a fluid that the ants are supposed to eat, and this will explain why the ants permit these beetles to live in their nests. What *Adranes* eats is a mystery; but it is certain that the ants get more than they give in the association. I was convinced that the ants were friendly to the *Adranes*, as I placed other insects in the nest, which the ants immediately attacked with great fury and soon tore them to pieces.

"LADY-BIRDS."

The terminal shoots of a cherry-tree were covered thickly with *Aphidæ*, or plant lice; the leaves shriveled and turned brown; I thought the tree

would be ruined. On June 20 I observed many "Lady-birds" on the tree. The "Lady-bird," so-called, is a small beetle belonging to the family *Coccinellidæ.* Two species, especially, were very numerous: *Adalia bi-punctata* and *Brachyacantha ursina.* To-day, July 1, not one of these plant lice was to be found on the tree, but numerous cast-off skins of larvæ and pupa were everywhere hanging to the leaves, and told the story how silently and efficiently these friendly little beetles had done their work and saved the tree from complete destruction.

ADDITIONAL SPECIES OF COLEOPTERA.

Since the publication of the "List of Coleoptera observed in the vicinity of Cincinnati," in this JOURNAL, October, 1879, and additions, December, 1882, the following twelve species have been observed:

Heluomorpha præusta (Dej.), one specimen.
Eleusis pallidus (Lec.), several specimens.
Adranes Le Contei (Brend.), six specimens.
Chevrolatia amœna (Lec.), one specimen.
Corymbites Copei Horn, one specimen.
Obrium rubrum (Newm.), one specimen.
Chelimorpha cassidea (Fab.), one specimen.
Bolitophagus depressus (Rand), two specimens.
Rhipidandrus paradoxus (Beauv.) one specimen.
Wollastonia quercicola (Boh.), several specimens.
Orchestes niger, several specimens.
Choragus species (?), two specimens.

ERRATUM—APRIL NUMBER.

Page 23, lines 11, 12, 13, and in description of figures, for *Cerampora* read *Ceramopora.*

Vol. VII. No. 3.

THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

Publishing Committee.

JAMES W. ABERT, A. P. MORGAN,
GEO. W. HARPER, WALTER A. DUN.

OCTOBER, 1884.

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CONTENTS.

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THE JOURNAL

OF THE

Cincinnati Society of Natural History.

VOL. VII. CINCINNATI, OCTOBER, 1884. NO. 3.

PROCEEDINGS OF THE SOCIETY.

TUESDAY, *July* 1, 1884.

President Hunt presiding. Sixteen members present.

S. F. Trounstine and Reuben H. Warder were proposed for active membership.

The Minutes of the preceding (April) business meeting were read and approved.

The Minutes of the Executive Board for April, May and June were then read.

Dr. Walter A. Dun read a paper on "Recent Floods in the Ohio River." The paper described the physical conditions necessary to a destructive flood, and stated that forests had but little influence in changing these conditions. The height of the water in the river at Cincinnati during remarkable floods from the earliest records to the present year was given.

Dr. Langdon asked if the measurements were all reduced to one standard, viz.: the Water Works' mark.

Dr. Dun replied that the figures for years subsequent to 1832 were taken from the records of the Water Works Office.

The paper was referred for publication.

Mr. Chas. Dury read some notes on new Coleoptera collected in the vicinity of Cincinnati.

Mr. Dury's paper was also referred to the Publishing Committee.

Prof. J. F. James made some remarks upon certain markings on the rocks of the lower silurian which have been referred to seaweeds. Some of these he was confident were made by the movement of crinoid stems over the soft mud. The occurrence of the trails of annelids and markings

resembling rain-drops, seemed to indicate shallow water, if not shore lines.

Dr. Dun said he had observed, near the tops of the hills, something that resembled ripple marks.

The Secretary exhibited some galls of Cynips saltatorius, "the jumping gall," collected by Mr. E. P. Robbins near Greenfield, Highland County, Ohio. Mr. Robbins had observed vast numbers of them, and stated that the sound made by their movements resembled the patter of rain upon the leaves.

Mr. William Hubbell Fisher made some statements regarding the scientific value of "Gentry's Birds of North America," a book now being offered for sale in the city. The book was not considered of the highest value from a scientific standpoint.

Donations were received as follows: from Dr. Zipperlin, specimen crab; from Alfred Stokes, three specimens silk worm cocoons; from Smithsonian Institute, Proceedings U. S. National Museum, 1883,—Sigs. 32, 33; from Chas. Dury, Eighth Annual Report of Ohio Fish Commissioners; from Signal Service Officer, Weather Review, April, 1884; from D. L. James, three specimens plants; from C. B. Going, five species plants; from C. F. Low, specimens of concrete and ashes from mounds near Newtown; from S. A. Forbes, Normal, Illinois, Thirteenth Annual Report of State Entomologist; from University of Tokio, Japan, Okadairo Shell Mound of Hitachi; from Wm. McMaster, mounted specimens of Road Runner, California; from Miss Nettie Fillmore, eleven species California plants; from F. W. Putnam, two pamphlets on Anthropology; from G. W. Landers, specimens of scorpions from Mexico; from A. J. Woodward, M. D., specimen Pholas costata from Florida.

Adjourned.

August 5, 1884.

Dr. D. S. Young, President *pro tem.*, presiding. Ten members present.

Minutes of meeting for June read and approved.

A communication from Mr. U. P. James was presented and read, entitled "On Conodonts and Annelid Jaws," with descriptions of four new species from the Cincinnati Group.

The paper was upon motion referred to the Publishing Committee.

Mr. Chas. Dury read a paper "On the Oswego and Black Bass," in which he held that, though separated by most authors, the species were varieties arising from a difference in habitat and an abundance or deficiency of food. Ross Lake had been stocked with bass a few years ago, all of the small-mouthed species, and at this time none of that species have been

found, though the Oswego Bass is abundant. Swift running water seemed to be the home of the Black Bass, while the Oswego Bass was only found in ponds or slow running streams.

Dr. Dun said he had caught Oswego Bass in the Kanawha River under the Falls, in swift water, but thought that Mr. Dury's position was, in the main, correct.

Dr. Young said that the colors of fish vary with the season. In still streams all fish became larger and "more flabby." He had noticed that fish taken from the lake in winter were more deeply colored and of better shape than those taken in the autumn. In the Mohawk River in New York, bass vary from white to black and mostly with small mouths, a character supposed to belong exclusively to the Black Bass. He had caught the large-mouthed form in the same stream, but thought it had been bred in ponds in the vicinity which flow into the river. The mouths of all fish change with age. Mr. Dury's paper was referred for publication.

Dr. Dun exhibited some photographs of strata and specimens from Eden Park showing ripple marks.

Mr. J. F. James said he had observed similar markings in the strata on the river bank near Ludlow, Ky.

Messrs. R. H Warder and S. F. Trounstine were unanimously elected members.

On motion of Dr. A. E. Heighway, Sr., the Secretary was directed to convey to the Hon. John Follett the thanks of the Society for his kindness in procuring for the Museum from the Smithsonian Institution a specimen, preserved in alcohol, of *Pentacrinus decorus*, dredged from the Gulf Stream.

A collection of 108 species of North American Coleoptera, collected and mounted by Mrs. Chas. Dury, was presented to the Society.

Donations were received as follows: from the Bureau of Education, three pamphlets; from Chas. Dury, one pamphlet; from Smithsonian Institution, Proceedings U. S. Nat. Museum—Vol. VII., Nos. 1 to 9; from A. Stoehr, two pigeon eggs; from Hon. John F. Follett, one specimen, Pentacrinus decorus, in alcohol; from Chief Signal Service Weather Review for May, 1884; from Miss Nettie Fillmore, one specimen Lilium Canadense; from Miss Adeline A. Stubbs, one specimen Lilium Grayii, Roan Mt., N. C.; from R. H. Warder, one specimen Frangula Caroliniana; from Dr. R. M. Byrnes, two specimens Astragalus Cooperi, one specimen Chenopodium botrys and two specimens Erysimum cheiranthoides; from J. F. James, specimens of fossils, shells and insects from Kentucky and Mammoth Cave, one pamphlet, Contributions to Flora of Cincinnati; from

Wm. Wiswell, through Dr. A. E. Heighway, Sr., specimen of wood and bark of Sequoia gigantea, California; from E. A. Keeshan, specimen of Horned Toad; from A. E. Heighway, Jr., one volume, Gordon's Pinetum; from Mrs. Chas. Dury, 108 species N. A. Coleoptera.

Adjourned.

TUESDAY EVENING, *September* 2, 1884.

Vice-President Harper presiding. Eleven members present.

Minutes of August meeting read and approved.

Col. James W. Abert read a paper on the "Village Indians of New Mexico," illustrating his remarks with blackboard sketches.

Referred to Publishing Committee.

Prof. J. F. James presented a paper on "The Fucoids of the Cincinnati Group." The author held that many of the markings on the rocks hitherto referred to organic origin are probably due to such natural phenomena as rainfall on muddy flats, or to waves running over soft mud.

Prof. Harper said that the thoughts brought forward by Mr. James were quite similar to those passing through his mind during a sojourn at the seashore this summer.

The paper was referred.

A letter from Mr. Chas. Dury, asking that a committee be appointed to procure from the Exposition Commissioners, if possible, a collection of minerals from Colorado, now on exhibition.

The Society thanked Mr. Dury for his letter, and referred it to the Executive Board for attention.

The Society then adjourned.

Donations were received as follows: From C. B. Going, seeds of *Sparganium eurycarpum;* from Signal Service Bureau, Monthly Weather Review for June, 1884; from Dr. D. T. D. Dyche, specimen of Fossil Sponge and *Depranodus arcuatus*, from near Lebanon, Ohio; from Prof. F. W. Putnam, one pamphlet; from U. S. National Museum—Plates VIII. to XIV. inclusive, to Vol. VI., Proceedings U. S. National Museum; from John Schimmel, Ohio Statistics for 1881; from Chas. E. Beecher, pamphlet on Ceratiocaridæ; from Smithsonian Institution, Annual Report for 1882; from U. S. Fish Commission, Nos. 9 to 16 of Bulletin of the U. S. Fish Commission; from Lieut. Thos. L. Casey, two copies of "Contributions to Descriptive and Systematic Coleopterology of North America," Part I.; from Zoölogical Garden, Cincinnati, specimens of *Cercocebus collaris*, *Cynocephalus Mormon*, *Lemur brunneus*, *Cebus fatuellus*, *Semnopithecus entellus*, *Dasyprocta punctata*, *Erinaceus Europæus* and *Didelphys quica;*

from J. F. James, Cones of *Larix Europæus* and specimen of *Anomalodonta alata;* from S. T. Carley, specimens of *Unio alatus* and *Margaritana complanata;* from Jas. R. Challen, specimens of Free Gold in Quartz; from Dr. O. D. Norton, Kidney Iron Ore; from D. W. Lewis, Flint Spear Point and Snake; from Wm. R. Moore, specimen of clay from Green Township, Hamilton County, O.; from Dr. Zipperlen, photograph of *Proteus;* from Jas. R. Newman, Secretary of State of Ohio, Ohio Agricultural Reports for 1880, 1881, 1882.

SPONGES.

By Edward M. Cooper.

Perhaps no other branch of the Animal Kingdom led early naturalists into so many errors, and has been the cause of so much mistaken conjecture, as the sponge. Known as it has been from times of the highest antiquity, it was to the ancients something between a plant and an animal. Rondelet denied at first the existence of sensibility in sponges, and originated the idea that these productions belonged to the Vegetable Kingdom. An idea which even Linnæus in the first editions of his "Systema Naturea" supported by the great authority of his name. Afterward, influenced by the convincing labors of Trembly and some other observers, Linnæus, withdrew the sponges from the Vegetable Kingdom and maintained their animal nature, his views being adopted by the great naturalists of Europe; and the more information we gain on the subject, the more convincing is the proof that such a view is correct. For subsequent observations have proved that the living sponge has the power of opening and closing at pleasure its oscula (or large openings) which are capable of acting independently of each other, thus fully establishing the animal nature of these simple organizations, in which latterly even traces of sensibility have been detected, such as one would hardly expect to meet with in a sponge. For these creatures, as we are entitled to call them, are able to protrude from their oscula, the gelatinous membrane which clothes their channels, and on touching these protruded parts with a needle, they were seen by Mr. Gosse to shrink immediately; a proof that the sponge, however low it may rank in the Animal World, is yet far from being so totally inert or lifeless as was formerly imagined.

Sponges inhabit every sea and shore, and extend to all depths of the

ocean, but perhaps attain their maximum development between 500 and 1,000 fathoms. They differ very much in habit of growth, for whilst some can only be obtained by dredging at considerable depths, others live near the surface, and others again attach themselves to the surface of rocks and shells between the tide marks.

The branched sponges, with a compact, feltred tissue, are more common than others in the colder, martime domains, where the species of a loose texture, which grow in large massive forms, either do not exist or are very rare. Many sponges are of considerable size, such as the vase-like tropical species, known under the name of Neptune's Cup. Others are almost microscopical and while by far the greater number grow superficially from a solid base, some penetrate like destructive parasites into the texture of other animals.

Zoölogists generally class the sponge with the protozoa, but Haeckel's investigations led him to decide that the sponge is not a protozoan, but belongs to a type only less highly organized than the lower polyps, and with more analogy to the radiates than the protozoa. He regards them as closely allied to the hydroid polyps, and his reasons are based on the fact that the sponges are made up of two layers of cells (Ectoderm and Endoderm, or outer and inner layers) surrounding a central cavity, and that both reproduce by eggs and spermatozoa. Gegenbaur and some English naturalists have indorsed this view.

Lieberkühn made the discovery—confirmed by Haeckel—that sponges are really Hermaphrodite Animals, reproducing by eggs and sperm cells developed in the same individual sponge. Haeckel showed that they were probably developed from the inner (Endodermal) layer of cells forming the body. These cells transform into an egg in the following manner: at first, provided with a collar and flagellum, it begins to draw these in until they disappear, then a nucleus appears within the nucleolus of the cell. The egg soon becomes detached from the body-wall, and moves about, sometimes penetrating into the exoderm or emigrating from the stomach to be fecundated abroad. After fecundation of the egg it begins to undergo self-division, splitting into two, four, eight, sixteen, etc., nucleolinated cells; the process being exactly as in the eggs of nearly all the higher animals, including man. This stage of segmentation Haeckel terms the Morula Stage. The cells of the Morula afterward separate into two kinds, a few remaining round, the majority becoming long and prismatic, and provided each with a cilium, by means of which it swims about and looks like a "planula" or larval Jelly Fish. This stage Haeckel consequently calls the Planula Stage; the next step is the forma-

tion of a stomach or internal cavity in the body of the ciliated larva. After swimming about for a time it becomes fixed by the end of the body to some object, the cavity finally opening out by a mouth. Afterward the true sponge character of the organism is revealed. The body wall becomes perforated with pores, which open into the general cavity of the body, while currents of water are maintained by means of the cilia, and flow out through the so-called mouth. This is the proto-spongia state, and when spicules of silex or lime are developed to strengthen the walls of the body, the young sponge is termed the "Olynthus."

Hartwig says of the Porifera, or sponges, that they were formerly supposed to belong to the Vegetable Kingdom, but their animal nature is now fully ascertained. For modern research has proved that the soft glairy substance with which their skeleton is invested during life, consists of "sarcode" similar to that which forms the soft parts of the Foraminifera and Polycystina. It is by this animated or organic gelatine, which can generally be pressed out with the finger, and in some species is copious to nauseousness, that the solid parts of the sponge are deposited, and from it the whole growth of the mass proceeds.

The framework or skeleton of the Porifera is usually composed of horny fibers of unequal thickness, which ramify and interlace in every possible direction, anastomosing with each other, so as to form innumerable continous cells and intricate canals, the walls of which in the recent sponge are crusted over with the gelatinous living cortex. Generally this fibrous mass is interwoven with numerous mineral spicules of a wonderful elegance and variety of forms, for their shapes are not only strictly determinate for each species of sponge, but each part of the sponge, it is believed, has spiculæ of a character peculiar to itself. Sometimes they are pointed at both ends, sometimes at one only, or one or both ends may be furnished with a head like that of a pin, or may carry three or more diverging points, which sometimes curve back so as to form hooks; sometimes they are tri-radiate, sometimes stellar; in some cases smooth; in others beset with smaller spinous projections like the lance of the Saw Fish. In many species they are imbedded in the horny framework; in others, as for instance, in Tethia Cranium, or in Halichondria, they project from its surface like a tiny forest of spears. They are generally composed of silex or flint, but in the Genus Grantia they consist of carbonate of lime.

Though the skeleton of most sponges is formed both of horny fibers and of mineral spicules, yet the proportions of these two component parts vary considerably in different species. In the common sponge, for instance, the

fibrous skeleton is almost entirely destitute of spicules, a circumstance to which it owes the flexibility aud softness that render it so useful to man; while they predominate in the Halichondria, and sometimes even as in the Grantia completely supersede the horny fabric

On examining a sponge, the holes with which the substance is everywhere pierced may be seen to be of two kinds: one of larger size than the rest, few in number and opening into wide channels and tunnels which pierce the sponge through its center; the other minute, extremely numerous, covering the wide surface and communicating with the innumerable branching passages which make up the body of the skeleton. Through the smaller openings or pores, the circumambient water freely enters the body of the sponge, passes through the smaller canals, and ultimately reaching the larger set of vessels, is evolved through he larger aperturest or Oscula. Thus by a still mysterious agency (for the presence of Cilia has as yet been detected in but one genus of full-grown marine sponges), a constant circulation is kept up, providing the sponge with nourishing particles and oxygen and enabling its system of channels to perform the functions both of an alimentary tube and a respiratory apparatus.

Dr. Grant describes in glowing terms his first discovery of this highly interesting phenomenon. "Having put a small branch of sponge with some sea water, into a watch glass in order to examine it with the microscope and bringing one of the apertures on the side of the sponge fully into view, I beheld for the first time the spectacle of this living fountain, vomiting forth from a circular cavity, an impetuous torrent of liquid matter, and hurling along in rapid succession opaque masses, which it strewed everywhere around. The beauty and novelty of such a scene in the Animal Kingdom long arrested my attention, but after twenty-five minutes of constant observation, I was obliged to withdraw my eye from fatigue, without having seen the torrent for one instant change its direction or diminish in the slightest degree the rapidity of its course. I continued to watch the same orifice at short intervals for five hours, sometimes observing it for a quarter of an hour at a time; but still the stream rolled on with a constant and equal velocity."

The innumerable canals by which the sponge is traversed—according to Milne-Edwards—are at once its digestive organs and breathing pores. The vibratile cilia are necessary to the renewed æration of the water required as a respiratory fluid in the interior canals of the sponge. The currents in these channels have one constant direction. The water penetrates the sponge by the numerous orifices of minute dimensions and irregular disposition; it traverses channels in the body of the mass and finally makes its

escape by special openings. Thus the channels perform the two functions of digestion and respiration. The rapid currents of ærated water which traverse them lead into them the substances necessary to the nourishment of these strange creatures, and at the same time carry off all excremental matter. At the same time the walls of these canals present a large absorbing surface, which separates the oxygen with which the water is charged and disengages the carbonic acid which results from respiration.

At the present time sponge fishing takes place principally in the Grecian Archipelago and the Syrian Littoral. The Greeks and Syrians sell the product of their fishing to the Western nations. Fishing usually commences towards the beginning of June on the coast of Syria and finishes at the end of October. But the months of July and August are peculiarly favorable to the sponge harvest. Lalakia furnishes about ten boats to the fishery. Batroun twenty, Tripoli twenty-five to thirty. Kalki fifty. Simi about one hundred and eighty and Kalminos more than two hundred. The boat's crew consists of four or five men, who scatter along the coast for two or three miles in search of sponges under the cliffs and ledges of rock.

Sponges of inferior quality are gathered in shallow waters: the finer kinds are found only at a depth of from twenty to thirty fathoms. The first are fished for with a three-toothed harpoon, by the aid of which they are torn from their native rocks, but not without deteriorating them more or less. The finer kinds of sponges are collected by divers: aided by a knife, they are carefully detached. Thus the price of a sponge brought up by diving is much more than that of one harpooned. Among divers, those of Kalminos and of Psara are particularly renowned. They will descend to the depth of twenty-five fathoms, remain down a shorter time than the Syrian divers and yet bring up more sponges. The fishing of the Archipelago furnishes few fine sponges to commerce, but a great quantity of very common ones; the Syrian fisheries furnish many of the finer kinds, while those from the Barbary Coast are of great dimensions and of a very fine tissue.

As fossils, the sponges are among our oldest inhabitants, occurring, as they do, largely in the silurian and then on through nearly all the formations, until in the cretacious we find the chalk almost wholly composed of the remains of sponges and rhizopods. Shells perforated by the Boring Sponge (Cliona) appear in the silurian rocks, while species of the same genus inhabiting our seas to-day show that their race has survived from the earliest Palacozic times until now. The great bulk of the Jurasic, "Sponge-Limestone," consists of the remains of calcareous sponges. This

immense deposit is thickest in Suabia to Franconia, but thins out gradually as it extends through Switzerland and Bourgogne; in Suabia there are rocky walls and cliffs many hundreds of feet high where no stone can be turned without exhibiting traces of sponge structure.

No very satisfactory classification of the sponges has as yet been made, although many recent writers have attempted, with more or less success, to arrange the very numerous forms now known into definite groups.

With a few exceptions, all sponges contain spicules. These are either silicious or calcareous. We may, therefore, divide the sponges into two sections, the first being called Calcarea. Skeleton chiefly composed of calcareous spicules, which are generally three-rayed. All the species are marine, and none appear to attain large dimensions, while some of the very smallest sponges known belong to this section—Grautia Compressa, one of the commonest British sponges, will serve as an example.

The second section is called the Silicia. Skeleton mostly horny, most frequently strengthened with silicious spicules; these are sometimes absent, and, in at least one genus, the sarcode becomes not even differentiated into a horny skeleton. The sponges belonging to this section are found both in fresh and salt water. Prof. Schmidt proposes to divide it into three divisions:

1. Where the spicules assume a sex-radiate type. To this will belong some of the most remarkable and beautiful sponges, as the Euplectella.

2. Where the spicules are anchor-shaped, or of a pyramidal form, containing many very familiar genera; especially the genus Spongilla, met with in fresh water.

3. Where the spicules are monaxial, polyaxial, or wanting; here, amongst a host of genera and species, would be placed the genus Spongia, to one or more species of which the various sponges known as sponges of commerce must be referred.

Probably the most beautiful and curious of all sponges are those known as the Glass Sponges. As early as 1835, the distinguished naturalist, Von Siebold, brought from Japan some curious wisps of glass hair measuring about twelve inches in length. Similar specimens were subsequently sold as seaweed by the Japanese curiosity mongers to European tourists and seamen. One end of these wisps was usually inclosed in a leathery sheathing and stuck into a piece of coral. Japanese ingenuity lends itself so freely to the concoction of impossible monsters, that anything strange, in the way of a natural curiosity, from that country is regarded with distrust. Combinations so skillfully made as to defy detection, except at the hands of the comparative anatomist, have made naturalists wary.

The first Hyalonema Sieboldii was therefore placed by the great microscopist, Ehrenberg, among the specimens of Japanese art. New specimens, less mutilated than the first one, were constantly added to the European museums, until finally Hyalonema was promoted from the cabinet of Japanese art to the museum of natural curiosities.

Still the question as to its origin and nature remained doubtful; the artificial combinations in which it was generally found, were very misleading. The investing leathery membrane was undoubtedly a polyp. The cup-shaped body which inclosed the wisp was no less certainly a sponge; but the wisp itself remained a mystery. This curious and anomalous form was to be classified, and the war of sponges began. All this time while the angry war of words went on, Hyalonema stood on its head waiting to be classified. Not one of all its angry champions knew enough to put it in its correct position. The conical mass had been from the first assumed as its base, out of which the spreading wisp of glass hair was supposed to spring upward into the water. Finally Prof. Lovin, of Christiana, pointed out the fact that the Hyalonema had been described in an inverted position. He first suggested that the glass coil was used for the purpose of anchoring the sponge in the mud, and, of course, formed its base. In 1868, Dr. Percival Wright brought up a specimen of Hyalonema from a depth of 600 fathoms in Setubal Bay, off the coast of Portugal.

The Holtenia, which was also dredged off the coast of Portugal, is in shape a symmetrical oval, or sphere, with a cup-shaped depression in the top. The two, however, which bear off the palm for exquisite beauty are the Rossella Velata and the Euplectella Speciosa. The Rosella is not unlike the Holtenia; its body is of a symmetrical oval form, composed of a beautiful network of glass spicules invested by the sarcode. The Euplectella is even more beautiful than any of the others; it is brought from the Philippine Seas. The first specimen was described and figured as early as 1841 by Richard Owen, and was called E. Aspergillum. In 1858 the E. Cucumer, and later, the most exquisite of all -the E. Speciosa—made their entrée into scientific society, the acknowledged queens of the Glass Sponges.

The Euplectella belongs to a very special group of sponges which have been called the Hexactinellidæ, from the circumstance that the silicious spicules throughout the whole family appear to be six-rayed. This fundamental form is often curiously masked—one, two, three or four of the rays being frequently suppressed; but where this is the case, some branching or splitting of the central canal, or some symmetrical arrangement of projections in the ornament of the spicule, is sure not only to refer it to its

ground form, but to give some clue to the particular kind of suppression or modification which has taken place.

The group belongs specially to the Deep Sea Fauna, and seems to thrive best among the elements of nascent limestones. The Euplectella, as we see it in collections, is simply the skeleton of the sponge, the soft, gelatinous coating having been removed. The skeleton is composed of silicia and resembles a delicate fabric woven in spun glass. It is in the form of a slightly curved tube, contracted downward and expanding upward to a wide circular mouth, edged by an elegant frill. The mouth is closed by a wide-meshed, netted lid. The walls of the tube are formed by a number of parallel longitudinal bands of glassy silicious fibers, closely united together by a cement of silica, and a series of like bands running around the tube and thus cutting the longitudinal bands at right angles, and forming a square-meshed net. The corners of the squares are then filled in with a minute irregular fretwork of silicious tubing, and the openings in the wall of the sponge become rounded. Ornamental ridges of the same fine fretwork are arranged in irregular spirals on the outer surface, and round the bottom of the tube a fringe of glistening threads of silica rises four or five inches long. The Glass Sponges have no commercial value, probably, except as curiosities, and were no doubt intended to represent the æsthetic side of Nature.

AUTHORITIES QUOTED: Figuier, Hartwig, Gosse, Haeckel, Milne-Edwards, Wyville Thomson, etc.

A BRIEF SKETCH OF THE FLOODS IN THE OHIO RIVER.

BY WALTER A. DUN, M. D., M. R. C. S.

Read before the Society, July 1, 1884.

The excessively high water, which we have all recently witnessed in the Ohio River, renders even a brief and necessarily incomplete consideration of the causes which produce it, very interesting. The daily papers, in answer to popular wish, have been filled with accounts of the vastness of the great overflow and sad tales of suffering, havoc and devastation. The editorial pages have not been silent. In almost every issue for a couple of weeks, in February last, they attempted a full and complete explanation, enumerated the causes and suggested a remedy, at least so far as this city is concerned.

In the multitudinous array of causes thus enumerated or among the numerous theories advanced, it would, indeed, be strange if the true ones

were not included. The difficulty arises in sifting, in separating the wheat from the chaff, and in allotting to each its proper value, without exaggerating its influence.

A record of the floods in the Ohio River will be found below in the order of their occurrences: In 1858 the gauge at the Cincinnati Water Works was established, and all records since that time are taken by that standard. The figures given before that time are from well-authenticated marks reduced to the Water Works standard. The gauge at the Water Works corresponds as nearly as possible with the depth of water on the Four Mile Bar above Cincinnati, and was as nearly exact as it was possible to make it when the standard was established.

The greater apparent frequency of high water in recent years may be due, in part, to the more accurate records. Yet allowing a great deal for this, there still seems to be a greater frequency in recent years than can be wholly accounted for in that way.

Reference to the list of floods at once shows that since 1858, when the records were begun, the river has reached more than forty feet each year. It is only in those floods of fifty feet or more that danger and damage occur, so that those are the ones which interest us particularly.

FLOODS IN THE OHIO RIVER OF FIFTY FEET OR MORE.

1774.—It is traditional that in March of this year there was a great flood in the Ohio.

American Pioneer, Vol. I., p. 345, says of Joseph and Samuel Martin: "The following winter the two brothers hunted on the Big Kanawha. Some time in March, 1774, they reached the mouth of the river on their return. They were detained here by a remarkably high freshet in the Ohio River, which, from certain fixed marks on Wheeling Creek, is supposed to have been equal to that of February, 1832."

1778–9.—John Cleves Symmes, in a letter to Col. Dayton, dated North Bend, May, 1789, says, that the whole country thereabout had been inundated, and that "the season was remarkable for the amazing height of the water in the Ohio, being many feet higher than had been known since the white people had come into Kentucky."

MEMORANDA BY JUDGE GOFORTH READS THUS:

"September 25, 1789, Major Stiles, old Mr. Bealer and myself took the depth of the Ohio River, and found that there was 57 feet of water in the channel, and that the water was 55 feet lower at that time than it was at that uncommonly high freshet last winter. The water at the high flood

was 112 feet." Not to cast doubt upon these early observers, we may allow considerable for the inaccuracy of their instruments and suppose that they struck a deep hole in the river in September. All accounts agree that there was an uncommonly high river, and it was probably of longer duration than ever since.

1792.—During this year there was a great flood covering the land now known as Columbia. The water must have been more than sixty feet.

1815.—Another great flood occurred this year, of less magnitude than 1792.

1832.—The weather conditions of February, 1832, were very similar to those that prevailed in February, 1883. A record of the former year at Cincinnati is not attainable; but Nathaniel Gates, who resided at Gallipolis, Ohio, a point on the Ohio River not so far distant from Cincinnati as to vary the conditions materially, made a daily record during the year, from which the following excerpta refer to the month of February:

"1st.—Warm and pleasant.

2d.—Warmer.

3d.—Warmer; 62°; snow going fast.

4th.—Warmer; 68°; snow all gone; soft mud plenty; river rising.

6th.—Rainy and muddy; river over the banks.

7th.—Cloudy and warm.

8th and 9th.—Rain all the time; 60°.

11th.—River rising; garden under water; pleasant weather; 67°.

12th.—Water rising fast; up to maxim.

14th.—Highest water known since the flood by three feet, and rising yet.

15th.—Water rising; houses, barns, hay and grain stacks in abundance.

16th.—Water at its maximum—four feet and two inches higher than ever seen by white men.

17th.—Water begins to fall slowly; the only towns on the Ohio banks not inundated are Gallipolis, Burlington and a part of Maysville, and the hill part of Cincinnati; all the fences and other movable property swept from all the farms on the river bottom from Pittsburg to Louisville, and how far below not yet known; cloudy, rainy, dull, disagreeable weather.

18th.—Water falling fast; warm; 60°.

19th.—Rain all day; plenty of mud.

20th.—Water out of the garden; snows continually, mingled with rain; Oh, what a disagreeable winter!—nothing agreeable or cheerful.

21st.—Rained.

22d.—Warmer; the sun appears twice.

23d.—Warm morning; cloudy; 10 o'clock, snows and is cold.

24th.—Cold, cloudy, wet and disagreeable.

25th.—Ditto, and mud enough to content anybody.

26th.—Continues cold and damp.

27th.—Cloudy; wet; some snow.

28th.—Rained all day moderately.

29th.—Clears off in the afternoon; chilly, damp atmosphere; snow not yet gone; roads and streets almost impassable.

This month is remarkable for many extraordinary circumstances, warnings, etc. The Ohio has done more damage by overflowing banks than has ever been done since the first settlement of the country. The destruction of houses, wheat, hay, corn, fences, etc., banks falling, bridges destroyed, all business suspended, general distress for wood, coal, etc., and no possibility of obtaining a supply."

Almost the same conditions brought about almost the same results in 1883 and 1884. The first great flood of which correct record now exists was that of February, 1832. There are several points in the city where permanent high water marks were made on the 18th day of the month, and they agree almost exactly. The stage of water on that date was 64 feet 3 inches. The population of the city then was 28,014, less than one-twelfth as numerous as now, and the city proper was bounded by the Miami Canal on the north, the Ohio River on the south, Deer Creek on the east and Western Row (Central Avenue) on the west. No such means as the telegraph, or even the railroad, existed by which the news of an approaching flood could precede it, and warn the inhabitants of coming danger. Unheralded, the water began to come on the 8th, and increased in volume ten days, at the end of which time it covered between thirty and forty squares of the city, which was nearly all then crowded into "the bottoms." Therefore, nearly the whole city was inundated, the effects being much more disastrous to Cincinnati of 1832 than to Cincinnati of 1883 or in 1884. Many houses floated away. Two lives were lost by the giving way of foundation walls, the men being buried in the wreck.

1847.—When Cincinnati contained about 96,000 inhabitants, the river began to swell December 10, 1847, and reached 63 feet 7 inches on the 17th. The rise was from streams on *both sides* of the river, that empty their water into the Ohio at points above here. There was a heavy fall of snow on the 15th.

1883.—February 15th, 66 feet 4 inches.

1884.—February 14th, 71 feet $\frac{3}{4}$ inches.

The record of rainfall since 1835, almost half a century, is given below. While only at one point, throughout the great Ohio Valley, the general uniformity of average is so marked that some weight may be given to it as indicating to a greater or less degree the general rainfall throughout the basin, it must be kept in mind that local rains often increase the monthly record, which is not a general increase throughout the whole area drained by the Ohio River. On the other hand a general rainfall shows an increase at this as at other points. Thus in July, 1875, 9.47 inches of rain fell, mostly during the latter part of the month, and the record here is of a general rainfall. Such an unprecedented and general outpouring gave rise to the only anomaly in the list of floods, viz., that of August 6, 1875—55 feet 5 inches.

The floods are directly dependent upon the amount of moisture precipitated throughout the valley, which is a statement apparently contradictory to the record of rainfall. The explanation lies in the fact that the record often shows great rainfall due only to local rains at this place; while during our winters moisture comes down as snow and hail, and accumulates, and when this melts during a general rainfall later, the streams have a double supply to carry off at once. The records and tables given have been taken from the Report of the Relief Committee of the Chamber of Commerce, of Cincinnati, 1883, U. S. Signal Service and Mr. R. B. Moore, JOURNAL CINCINNATI SOCIETY NATURAL HISTORY, Vol. I., page 57, and other sources already acknowledged.

This brief sketch, then, is defined at the outset as an attempt to give to each element, which lies at the cause of the floods in the Ohio, its proper value.

Upon consulting anyone, learned or ignorant upon this subject, all will be found filled with theories or explanations entirely satisfying and convincing to themselves, and the number and variety of these reasons is equaled only by the number you consult.

It is a settled maxim of physicians, that in any disease where a host of agents are recommended as remedies, none are reliable, and that the treatment of that disease is unsatisfactory. It is also equally true that, in any case where, after careful consideration, a number of good lawyers express directly opposite opinions, the law in the case is vague and indefinite.

The very fact, then, of the great variety of opinions as to the cause of floods, necessarily certifies to the rather obscure nature and understanding of them.

TABLE GIVING RAIN FALL AT CINCINNATI.

YEAR.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTALS.
1835	3.82	1.75	1.86	3.37	7.57	7.34	2.46	6.54	2.32	4.35	6.61	3.20	52.15
1836	2.97	4.34	4.18	4.54	9.01	2.14	7.42	5.54	4.77	3.71	4.41	4.36	57.39
1837	0.80	3.43	3.70	2.00	3.79	4.38	3.83	5.91	3.14	4.16	2.52	5.05	42.71
1838	1.90	1.64	0.56	4.74	8.57	7.55	2.47	3.76	0.71	3.55	3.12	0.85	39.45
1839	4.56	2.75	2.69	2.38	4.46	1.96	2.97	0.56	3.24	0.13	2.20	1.72	29.62
1840	1.13	4.68	3.62	4.78	6.08	6.84	4.45	3.73	1.56	4.74	2.50	3.20	47.34
1841	5.56	0.82	2.34	4.75	2.16	1.51	5.33	2.71	2.94	2.46	4.92	5.56	41.05
1842	2.75	6.09	3.02	2.97	3.04	5.67	2.35	4.22	2.95	1.90	3.76	2.57	41.29
1843	3.51	3.54	2.97	6.15	3.54	4.52	2.92	5.89	6.73	4.16	4.26	3.00	51.22
1844	3.10	1.04	4.50	3.13	7.00	6.16	3.50	3.65	1.26	4.32	3.18	1.10	41.94
1845	3.03	1.66	5.46	1.08	1.89	11.50	3.06	6.88	7.51	2.03	1.68	0.60	46.38
1846	3.59	3.20	2.26	3.51	5.17	7.53	3.93	6.10	2.50	2.19	4.26	9.25	53.52
1847	4.71	4.06	5.37	2.12	4.30	7.63	8.25	3.20	3.87	9.57	3.95	8.15	65.18
1848	4.58	2.81	6.72	0.55	5.13	1.86	6.95	3.90	1.53	3.62	2.60	9.43	49.68
1849	6.48	2.04	4.70	3.65	3.61	4.90	8.90	4.41	2.68	3.86	2.42	5.32	52.97
1850	5.20	6.28	6.62	4.27	1.86	5.00	6.30	7.20	2.22	1.05	2.54	6.22	54.76
1851	0.65	6.15	3.04	1.80	3.30	2.10	3.25	2.55	0.43	2.60	3.25	3.37	32.49
1852	2.03	5.20	5.16	5.80	3.15	5.25	2.05	4.35	4.15	2.75	4.57	9.89	54.35
1853	1.53	5.14	2.14	7.70	2.21	1.90	4.81	2.16	4.70	3.78	3.30	0.73	40.10
1854	4.10	5.57	8.33	2.97	7.29	4.84	2.32	3.18	2.12	3.01	3.66	3.38	50.69
1855	3.71	1.58	3.66	3.05	5.24	8.10	4.35	4.25	2.98	1.31	5.22	3.28	47.00
1856	1.00	2.49	1.51	0.72	1.23	2.24	3.43	0.61	3.62	1.74	2.09	2.19	22.87
1857	0.54	1.98	0.76	2.72	5.53	3.08	2.50	2.92	0.75	4.92	5.36	3.82	34.88
1858	2.06	1.74	1.05	4.34	8.32	5.69	3.01	7.97	0.85	4.66	2.57	6.41	48.67
1859	2.57	5.92	4.38	7.53	2.32	3.22	1.24	3.79	2.10	1.27	4.45	3.75	42.54
1860	1.43	1.56	0.41	5.31	3.68	1.55	7.96	0.92	4.33	1.28	3.53	1.85	33.81
1861	2.57	1.81	2.08	3.88	5.91	3.80	3.62	7.10	2.94	3.73	3.63	1.09	42.19
1862	4.74	2.36	5.84	6.30	3.82	3.02	3.00	1.49	0.93	0.80	3.97	3.01	38.78
1863	5.55	3.05	4.37	2.13	2.84	3.11	3.21	2.99	3.10	3.85	2.05	3.80	40.05
1864	1.85	0.99	0.90	2.43	2.34	3.43	1.25	3.42	8.64	2.90	3.40	2.94	34.50
1865	2.45	2.43	4.43	3.89	7.72	2.59	7.77	2.26	5.76	0.86	0.56	3.89	44.58
1866	2.74	1.26	5.06	2.03	0.94	4.44	6.94	2.75	10.55	1.85	3.06	1.98	43.60
1867	1.41	3.56	2.71	2.74	3.80	3.73	1.60	1.57	0.47	2.05	2.20	3.07	28.91
1868	3.72	0.57	4.87	2.72	6.09	5.60	1.21	4.04	7.19	1.22	1.70	2.07	41.60
1869	1.60	2.51	5.06	2.87	5.93	3.60	5.36	1.20	3.20	2.75	3.30	2.46	39.84
1870	5.33	1.55	3.26	1.59	1.74	4.84	2.38	0.58	0.30	2.77	1.50	2.17	28.03
1871	2·34	3.53	3.75	1.23	4.56	2.04	4.30	5.22	1.08	0.98	3.40	3.31	35.64
1872	0·85	1.75	1.59	5.56	2.48	3·20	8.00	3.19	1.39	2.64	1.00	0.89	32.54
1873	2.15	2.69	1.96	2.13	2.95	3.12	2.84	3.02	1.68	2.64	2.14	5.46	32.78
1874	3.37	4.40	3.03	5.23	1.15	2.25	3.47	1.05	1.69	0.98	4.42	2.34	33.38
1875	1.70	1.23	3.37	0.88	2.82	4.93	9.49	2.64	4.85	2.87	3.80	3.19	41.04
1876	9.49	2.92	5.07	3.26	1.25	6.67	6.91	6.38	3.17	4.26	2.36	0.88	52.62
1877	2.33	0.67	5.47	2.32	1.76	5.24	4.25	2.26	1.66	1.85	3.49	3.35	34.65
1878	4.33	2.33	4.03	3.05	2.53	5.03	4.32	4.11	2.84	2.39	2.77	3.89	41.62
1879	2.20	2.22	5.30	2.14	4.23	5.22	2.75	11.72	4.01	0.65	4.05	7.11	51.60
1880	5.14	4.50	4.15	5.82	5.70	9.87	2.46	4.01	1.37	2.98	4.42	4.26	54.67
1881	3.76	4.95	3.51	3.25	2.23	7.82	3.12	0.76	2.10	6.01	4.06	5.67	47.24
1882	6.02	7.04	6.17	2.71	8.47	4.34	2.91	5.75	3.16	1.59	1.57	2.39	52.12
1883	2.82	8.22	3.48	3.72	5.49	3.61	2.21	2.10	1.83	8.39	4.87	5.61	52.35
1884	2.21	8.87	2.63	3.02	5.56	2.77							25.06
M'ns	3.12	3.38	3.85	3.47	4.28	4.53	3.96	3.83	2.99	2.94	3.27	3.71	43 33

TABLE OF HIGH WATER IN THE OHIO RIVER AT CINCINNATI.

YEAR.	DATE.	FEET.	INCHES.
1832	February 18,	64	3
1847	December 17,	63	7
1858	June 16,	43	10
1859	February 22,	55	5
1860	April 16,	49	2
1861	April 19,	49	5
1862	January 24,	57	4
1863	March 12,	42	9
1864	December 23,	45	1
1865	March 7,	56	3
1866	September 26.	42	6
1867	March 14,	55	8
1868	March 30,	48	3
1869	April 2,	48	9
1870	January 19,	55	3
1871	May 13,	40	6
1872	April 13,	41	9
1873	December 18,	44	5
1874	January 11,	47	11
1875	August 6,	55	5
1876	January 29,	51	9
1877	January 20,	55	9
1878	December 15.	41	5
1879	December 27,	42	9
1880	February 17,	53	2
1881	February 16,	50	7
1882	February 21,	58	7
1883	February 15—5 A. M.	66	4
1883	April 13,	46	3
1883	December 28,	49	5
1884	February 14,	71	0¾
1884	March 17.	49	8

The great basin of the Ohio River and its tributaries may be likened to an immense funnel, whose area is considerably more than 50,000 square miles. From the north this basin has only a slight fall, while from the headwaters and the south the slope is very rapid. Water poured into this funnel affects the outlet most markedly when precipitated upon the regions about the headwaters and on the southern slope. So that a part of the rapid fluctuations is due to the sudden flushings from the mountains by the Allegheny, Monongahela, Great Kanawha, Little Kanawha and Big Sandy Rivers. After a general rainfall throughout the basin, the mountain streams *run out*, and a large portion of their rise has been conveyed down

stream before the rise in the more sluggish rivers of the northern slope is ready to empty in. If it were not for this fact, overflows would be much more frequent than they really are, for, as we shall see further on, it is when under rare conditions that the rise from *both sides* of the river is emptied into it at the same time, that the disastrous floods occur. Let it be distinctly understood that the floods are directly connected with the amount of moisture precipitated thoughout the basin, and that the river, like the outlet of a funnel, overflows whenever the amount thrown down is greater than it can discharge.

Coming next to a consideration of the records of the various rises in the river, I shall consider all those above fifty feet, including those uncertain ones before the days of record, and beginning with the Indian legend "From hill to hill."

1774.— . . . . 63 feet + (?)

Some time in March, 1774, two brothers, Joseph and Samuel Martin, reached the mouth of the Big Kanawha, where they were detained by a remarkably high freshet in the Ohio.

1789. Remarkable freshet during the winter, which Judge Goforth says was 112 feet high.

1792. Flood with over 60 feet of water. The time of the year is not stated.

1815. Another great flood. Time of year not mentioned.

1832.	February 16th,	water	64	feet	3	inches.
1847.	December 17th,	"	63	"	7	"
1859.	February 22d,	"	55	"	5	"
1862.	January 24th,	"	57	"	4	"
1865.	March 7th,	"	56	"	3	"
1867.	March 14th,	"	55	"	8	"
1870.	January 19th,	"	55	"	3	"
1875.	August 6th,	"	55	"	5	"
1876.	January 29th,	"	51	"	9	"
1877.	January 20th,	"	53	"	9	"
1880.	February 17th,	"	53	"	2	"
1881.	" 16th,	"	50	"	7	"
1882.	" 21st,	"	58	"	7	"
1883.	" 15th,	"	66	"	4	"
1884.	" 14th,	"	71	"	$\frac{3}{4}$	"

Among those floods before 1832, so far as record goes they are assigned to the winter and spring, so that they materially strengthen the position

which is deducible from a statistical consideration of the record of the past fifty-two years.

The total number of floods from 1832 to 1884 inclusive, reaching above 50 feet of water in the channel, is fifteen, or one every three and a half years, on the average.

One occurred in 1875 under continued and unusual rainfall (very exceptional conditions), in August.

One occurred in December, 1847.

Two occurred in March, 1865, 1867.

Four occurred in January, 1862, 1870, 1876, 1877.

All the remaining seven occurred in the month of February.

A period, embracing from December 15th to March 15th, includes all the floods but one for the whole period of fifty-two years; while a shorter period, from January 15th to March 1st, includes all but four. December, January, February and March are the months of the year when the floods are to be looked for, and in this seasonal differentiation, so strongly marked by the record for more than fifty years, we must look for a factor which, when added to the amount of rainfall, will aid us to the solution of the problem.

We have this factor in the agency of cold. It precipitates moisture in the form of snow, allows it to thus accumulate in immense banks in mountains and valleys; throughout the entire basin vast quantities are thus piled up. The ground beneath is also frozen, and thus becomes impervious to water, which can not disappear in it.

The third and great factor is to be found from a careful study of meteorological observations, which have been compiled in recent years through our valuable Signal Service. A very valuable pamphlet upon the weather, by S. S. Bassler, Esq., has recently been published in Cincinnati, and it especially points out the fact that storms are areas of low barometer, which travel along broad, through pretty distinct and well-beaten paths. The Ohio Valley is the track of storms from the Gulf of Mexico and from the great Northwest. During the winter months this is especially true. One or two cold storms, with snow from the Northwest, are followed by warm storms with rain from the Gulf. Thus we find ourselves in the track of both cold and warm storms; and so constant and sudden is the predominance of first one, and then the other, that we are in a climate of perpetual and rapid change.

The conditions as regard banked snow are often present for a flood. You will all recall that upon December 22, 1883, a great amount of snow fell. It was settled by several inches of fine hail, so that the amount of con-

gealed moisture spread over the Ohio Valley was very great. On Sunday, December 23, a warm wave with rain from the Gulf came. Everything was favorable for a great flood. Had that warm wave lasted long enough and continued to pour its rain down upon the snow, a flood would have resulted. Luckily a cold wave from the Northwest came, predominated over the warm one from the Gulf, precipitated its moisture as snow, froze up the rain, stopped the melting, and the danger for that time passed.

This very snow formed the groundwork of our present flood. Throughout January more snow was added, with only slight thaws between, until over three feet of snow had fallen, and, for the most part, accumulated over the whole Ohio Valley. At last the warm storms from the Gulf and Southwest, superabundantly laden with rain, came. Day after day they rained out their warm torrents upon the snow accumulation, until many inches of rain were added to the melting snow. In vain did we look for our cold storm to call halt upon the gush of rain and melting snow. Strong were the hopes for a cold snap to stop with its icy fingers the dangers with which we were threatened. For fourteen days no sun cast a gleam of cheer. All the conditions were here; excessive rainfall, accumulated snow from cold waves, and continued warm air from the South, and the flood came, as I believe, more as a result of the combination of these conditions than anything else.

A recent number of *Puck*, catching the popular craze, has illustrated the forestry idea with peculiar vividness. Let us cast a glance for a moment at this idea. It has been the misfortune of the writer to witness a great overflow in the Rhine in 1882, and yet there is no country of the globe so particular or so scientific about public forests and forestry as Germany, where a certain area is set apart, proportioned upon the best known principles of forestry, and forests are cultivated thereon; and if, by chance of nature, a tree is blown down or rots away, its place is immediately supplied by another young one. In 1882, the writer also saw one of the greatest overflows in the history of the Danube River. Its headwaters are in Germany, and Austria is about as particular as Germany about this forestry craze. The Po, also, in Italy, overflowed and inundated the surrounding country. Yet forestry prevails there, if not as perfect as in Germany, at least with as good results. The overflows of all those rivers were directly dependent upon the amount of moisture precipitated, and not upon the absence or presence of the forests or their attending influences.

Not only have forests not availed anything practical for the floods in these countries, but even the fluctuations of the Rhine and Rhone are removed beyond their influence, and come in summer and go in winter from

the melting or freezing of Alpine snows above the tree-line, where there are no trees to influence it, but where warm air can and does.

The annual inundations of the Nile, also, are due to the *direct rainfall during the wet season in that immense central lake basin of Africa* described by Livingston and Stanley. The dense tropical forests and impenetrable jungles there do not seem to stop the rise of precipitated waters, or aid the forestry planters in their theory that the forest acts like a sponge and foliage prevents the access of the sun's rays to evaporate. The impassable jungles of India, and the vast forests and foliage of that tropical climate, do not prevent the great rises in the Ganges, when the wet season pours down its rain. The same is true of the Amazon; so that turn where you will, you are confronted by the facts that the floods come from precipitated moisture—from rain or accumulated snow; that their extent depends upon the amount of moisture precipitated, coupled with the warm air to aid to melt that which is congealed, and not upon the forests or penetration of the sun's rays. What sun's rays did we have in our recent fourteen days of gloominess to aid in melting the snow faster? Yet it melted, and rapidly, too. What protection are foliage or trees to permeating warm air, like what we so often have in our warm waves? So far as the sponge-theory part is concerned, it amounts to this: the soil is the great sponge and vat; when its pores are frozen up, as it recently was here, and water is dropped on, it runs off like water from a duck's back; then one of the elements for a flood or, rather, rapid freshet is present. I do not believe that forests and foliage act as a sponge, except so far that they resemble one soaked, upon which if you pour water, it already being full, an equal amount of water escapes. The obstruction and friction which trees are to water running down hill is something; therefore, on the whole, the effect of forestry is slight, but has, I think, been greatly overestimated.

There is indisputable evidence that a large part of the Ohio Valley was once a prairie like Illinois, and that herds of buffalo roamed over it. There is also evidence that a larger population than the Indians, viz.: the Mound Builders, once occupied and probably cleared a portion of it. Parts of it which are now thickets were known as prairie-land to the early pioneers; yet under all these variations, we have no evidence that it was barren recently, or that the rises in the river were once more frequent or extensive than at present; all of which should have been the case if the *theory* of forestry is as true for the Ohio Valley as for Asia Minor. No! either the theory is wrong, and the present barrenness of Asia Minor is due to other causes, or the theory can not be applied to the two regions. Lastly, if the forests protect us from floods, why did they not do so in 1774, 1789, 1792,

and in other floods accounting for the Indian legend, "From hill to hill," occurring at a time when scarcely a tree in the Ohio Valley had been felled by the white man?

The great theory of forestry accounting for floods and drouths does not seem to hold good on our great Western prairies. Illinois, Iowa, Northern Missouri, Nebraska and Kansas, as well as the great Red River Valley of the North and the great Northwest prairies, seem to be particularly fertile, and as free from drouth as regions covered with the native forests in all their glory. Enough has been said already, however, to convince the most skeptical, and to keep the forest humbugs and schemers for political offices, under this new idea, busy preparing even plausible explanations in order to have the facts fit their theory.

The last fact to which attention is to be directed is the greater frequency of floods in recent years. Dividing the fifty-two years of record into two periods—the first twenty-six years yielded two floods, the last twenty-six thirteen floods, while for the last five years we have had one each year. The cultivation of the soil, with increasing outlay in tile-draining, certainly facilitates the discharge of water which the great surface-soil of the earth, as a sponge, has before held back, and the ever-increasing facility for outlets may, in a measure, account for this. Meteorological observation has not been of long enough duration to enable us to say whether cold and warm waves are more frequent now than formerly, and whether our climate is gradually changing or not. Yet the frequency of the floods in recent years certainly suggests such a possibility, and we may look forward with pleasure to the further accumulation of those records to determine that point.

A brief summary of the meteorological conditions and stages of the water during the flood of 1884, extracted from the Report to the Relief Committee of the Chamber of Commerce by R. B. Stevenson, Esq., is here appended:

"The meterological causes of the flood began on the 14th day of December, 1883, when the winter's first fall of snow occurred in the Ohio Valley, less than 1 inch in depth at Cincinnati, where the stage of the Ohio River was 10 feet 7 inches on that day, a minimum to which it did not again decline for a period of six months or more. To the snow, on the date named, was added rainfall to the depth of sixteen-hundreths of an inch. Light snows fell on the 15th, 16th, 18th, and 19th of December, followed by a heavier snow on the 20th, and twelve hours of snow on the 22d, the fall of the day last indicated measuring $6\frac{3}{4}$ inches in depth. The snow then on the ground was partly removed and partly more closely

packed by a fall of sleet and rain on the 23d that equaled a rainfall of 2.57 inches, after which the temperature became so cold that ice appeared in the river the following day, which disappeared on the 28th, under the influence of light rains which fell on the 27th. Light rains, but enough to carry much of the snow into the river, and solidify that which remained on the ground, fell also on the 30th and 31st. The total fall of snow, sleet, and rain, during the month of December, reduced to rainfall, was 5.61 inches. The highest stage of the river during the month was 49½ feet, on the 28th, when it began to decline.

"Light snows were frequent, and a cold temperature prevailed from the 1st to the 14th of January, 1884, when a heavy snow set in at 5 P. M., and continued until the following day, and on the 19th there was another light fall of snow. These alternated with sleet and rain, and the temperature varied, during the last five days, between zero and 60 degrees above. The first half of the month was generally cold, but there were slight variations in the weather conditions. These variations and other influences were sufficient to cause the river to fall, first, from 49½ feet on December 28th, to 15 feet 5 inches on January 13th, then rise to 24 feet 1 inch on the 19th, then fall to 15 feet 9 inches on the 29th, and rise again to 31 feet 3 inches on the 31st, when the flood of 1884 properly began. The 30th of January found upon the ground much of the previous fall of 18 inches to 4 feet of solidified snow, packed upon the hills and mountains and valleys of the Ohio River and its tributaries, and the smaller streams tributary to the latter. The depth of snow that fell at Cincinnati during the month of January was 10 inches, and much more had fallen at other localities that would affect the condition of the river. The rainfall of the month was 1.23 inches. The snow, sleet and rain, reduced to rainfall, was 2.21 inches. One rain followed another from the 30th of January to the 13th of February, which affected the river accordingly."

STAGES OF WATER, FEBRUARY, 1883–4.

Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.	Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb.	1— 6 A.M.	29	1	36	4	Feb.	2— 3 A.M.			43	6
"	10 "			37	7½	"	6 "	28	5	44	4
"	11 "			38	½	"	7 "			44	8
"	12 Noon	29	5	38	4½	"	8 "			44	11½
"	1 P.M.			38	8	"	9 "			45	3
"	2 "			39	—	"	10 "			45	6
"	3 "			39	5½	"	11 "			45	8
"	4 "			39	9	"	12 Noon	28	3	45	10½
"	5 "			40	1½	"	1 P.M.			46	1½
"	6 "	29	1	40	5½	"	2 "			46	5
"	9 "			41	6	"	3 "			46	7
"	12 Midnight			42	6½	"	4 "			46	9½

Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 2—	5 P.M.			46	11½
"	6 "	28	11	47	1
"	7 "			47	3½
"	8 "			47	5½
"	9 "			47	8
"	10 "			47	10
"	11 "			48	—
"	12 Midnight			48	2
Feb. 3—	6 A.M.	27	2	48	10½
"	8 "			49	½
"	9 "			49	1½
"	10 "			49	2½
"	11 "			49	4
"	12 Noon	27	—	49	4½
"	3 P.M.			49	6½
"	6 "	26	6	49	8
"	9 "			49	9½
"	12 Midnight			49	10½
Feb. 4—	3 A.M.			49	11
"	6 "	29	1	49	11
"	7 "			49	11½
"	8 "			49	11½
"	9 "			49	11
"	10 "			49	11
"	12 Noon	30	—	49	10½
"	1 P.M.			49	10½
"	2 "			49	10½
"	3 "			49	11
"	4 "			50	½
"	5 "			50	2
"	6 "	30	4	50	3
"	9 "			50	7½
"	12 Midnight			51	½
Feb. 5—	3 A.M.			51	4½
"	6 "	30	2	51	7½
"	7 "			51	8½
"	8 "			51	9
"	9 "			51	10
"	10 "			51	11
"	10:30 A.M.			52	—
"	11 "			52	2
"	11:30 "			52	3
"	12 Noon	30	5	52	4½
"	12:30 P.M.			52	5½
"	1 "			52	7
"	1:30 "			52	8½
"	2 "			52	9½
"	2:30 "			52	11
"	3 "			53	—
"	3:30 "			53	1½
"	4 "			53	2½
"	4:30 "			53	3½
"	5 "			53	4½
"	5:30 "			53	5½
"	6 "	30	6	53	6½
"	7 "			53	8½
"	8 "			53	10½
Feb. 5—	9 P.M.			54	2
"	10 "			54	6
"	11 "			54	10
"	12 Midnight			55	3
Feb. 6—	1 A.M.			55	7
"	2 "			55	11
"	3 "			56	2
"	4 "			56	7
"	5 "			56	11½
"	6 "	29	5	57	3½
"	7 "			57	7
"	7:30 A.M.			57	9
"	8 "			57	11
"	8:30 "			58	½
"	9 "			59	2
"	9:30 "			58	4
"	10 "			58	5½
"	10:30 "			58	7
"	11 "			58	9
"	11:30 "			58	11
"	12 Noon	29	5	59	—
"	12:30 P.M.			59	2
"	1 "			59	3½
"	1:30 "			59	5
"	2 "			59	7½
"	2:30 "			59	9
"	3 "			59	9
"	3:30 "			59	10
"	4 "			59	11
"	4:30 "			59	11
"	5 "			60	1
"	5:30 "			60	2
"	6 "	29	10	60	3
"	6:30 "			60	4½
"	7 "			60	5
"	7:30 "			60	6
"	8 "			60	6½
"	8:30 "			60	7½
"	9 "			60	8½
"	9:30 "			60	9
"	10 "			60	9½
"	10:30 "			60	10
"	11 "			60	11
"	11:30 "			60	11½
"	12 Midnight			61	—
Feb. 7—	12:30 A.M.			61	—
"	1 "			61	—
"	1:30 "			61	½
"	2 "			61	1
"	2:30 "			61	2
"	3 "			61	2
"	3:30 "			61	2½
"	4 "			61	3½
"	4:30 "			61	3½
"	5 "			61	4
"	5:30 "			61	4½
"	6 "	39	4	61	4½

Date.	Time.	1883. Ft.	In.	1884. Ft.	In.
Feb.	7— 6:30 P.M.			61	5¼
"	7 "			61	5½
"	8:30 "			61	6
"	9 "			61	6½
"	9:30 "			61	6¾
"	10 "			61	6¾
"	10:30 "			61	7
"	11 "			61	7¼
"	11:30 "			61	7½
"	12 Noon	42	8	61	7¾
"	12:30 P.M.			61	8
"	1 "			61	8¼
"	1:30 "			61	8¼
"	2 "	44	2	61	8½
"	2:30 "			61	8½
"	3 "	44	10	61	8½
"	3:30 "			61	9
"	4 "	45	2	61	9
"	4:30 "			61	9
"	5 "	45	7	61	9½
"	5:30 "			61	9½
"	6 "	46	3	61	9½
"	6:30 "			61	9½
"	7 "	47	—	61	9½
"	7:30 "			61	9½
"	8 "	48	—	61	9½
"	8:30 "			61	9½
"	9 "			61	9½
"	9:30 "			61	9¾
"	10 "			61	10
"	10:30 "			61	10¼
"	11 "			61	10¼
"	11:30 "			61	10½
"	12 Midnight	48	9	61	10¾
Feb.	8—12:30 A.M.			61	11
"	1 "			61	11¼
"	1:30 "			61	11¾
"	2 "	49	6	62	—
"	2:30 "			62	¼
"	3 "			62	½
"	3:30 "			62	¾
"	4 "	50	3	62	1
"	4:30 "			62	1¼
"	5 "			62	1½
"	5:30 "			62	1¾
"	6 "	50	10	62	2
"	6:30 "			62	2½
"	7 "			62	3
"	7:30 "			62	3½
"	8 "	51	5	62	3½
"	8:30 "			62	4
"	9 "	51	7	62	4½
"	9:30 "			62	4½
"	10 "	51	10	62	5½
"	10:30 "			62	5½
"	11 "	52	2	62	5¾
"	11:30 "			62	6

Date.	Time.	1883. Ft.	In.	1884. Ft.	In.
Feb.	8—12 Noon	52	5	62	6½
"	12:30 P.M.	52	6½	62	6½
"	1 "	52	8	62	7
"	1:30 "	52	9½	62	7
"	2 "	52	11	62	7½
"	2:30 "	53	½	62	7½
"	3 "	53	3	62	8½
"	3:30 "	53	4	62	8½
"	4 "	53	5	62	9
"	4:30 "	53	6½	62	9½
"	5 "	53	8	62	9½
"	5:30 "	53	9½	62	9½
"	6 "	53	10½	62	10½
"	6:30 "			62	10¾
"	7 "	54	2	62	11
"	7:30 "			62	11¼
"	8 "	54	4½	62	11½
"	8:30 "			62	11¾
"	9 "	54	7	63	—
"	9:30 "			63	¼
"	10 "	54	9½	63	½
"	10:30 "			63	¾
"	11 "	55	—	63	1
"	11:30 "			63	1¼
"	12 Midnight	55	3	63	1½
Feb.	9—12:30 A.M.			63	1¾
"	1 "	55	5	63	2
"	1:30 "			63	2¼
"	2 "	55	7½	63	2½
"	2:30 "			63	2¾
"	3 "	55	10	63	3
"	3:30 "			63	3¼
"	4 "	56	—	63	3½
"	4:30 "			63	3¾
"	5 "	56	2½	63	4
"	5:30 "			63	4½
"	6 "	56	4	63	4¾
"	6:30 "	56	4½	63	5
"	7 "	56	5½	63	5½
"	7:30 "	56	6½	63	5½
"	8 "	56	7½	63	6
"	8:30 "	56	8½	63	6½
"	9 "	56	9½	63	6½
"	9:30 "	56	10½	*63	7
"	10 "	56	11½	63	7½
"	10:30 "	57	—	63	7½
"	11 "	57	½	63	7½
"	11:30 "	57	1	63	8
"	12 Noon	57	2	63	8½
"	12:30 P.M.	52	3	63	8½
"	1 "	57	3½	63	9
"	1:30 "	57	4	63	9
"	2 "	57	5	63	9½
"	2:30 "	57	6	63	9½
"	3 "	57	6½	63	10

* Flood height December 17th, 1847.

Date.	Time.		1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 9—	3:30	P.M.	57	7	63	10
"	4	"	57	8	63	10½
"	4:30	"	57	8½	63	10½
"	5	"	57	9	63	11
"	5:30	"	57	10	63	11¼
"	6	"	57	10	64	—
"	6:30	"			64	¼
"	7	"	57	11½	64	½
"	7:30	"			64	¾
"	8	"	58	½	64	1
"	8:30	"			64	1¼
"	9	"	58	2	64	1½
"	9:30	"			64	1¾
"	10	"	58	3	64	2
"	10:30	"			64	2¼
"	11	"	58	4	64	2½
"	11:30	"			64	2¾
"	12 Midnight		58	5	*64	3
Feb. 10—	12:30	A.M.			64	3¼
"	1	"	58	6	64	3½
"	1:30	"			64	3¾
"	2	"	58	7	64	4
"	2:30	"			64	4¼
"	3	"	58	8	64	4½
"	3:30	"			64	5
"	4	"	58	9	64	5¼
"	4:30	"			64	5¾
"	5	"	58	9½	64	6
"	5:30	"			64	6½
"	6	"	58	9½	64	7
"	6:30	"	58	9½	64	7½
"	7	"	58	9½	64	8
"	7:30	"	58	10	64	8
"	8	"	58	10	64	8½
"	8:30	"	58	10	64	8½
"	9	"	58	10½	64	9
"	9:30	"	58	10¾	64	9
"	10	"	58	11	64	9½
"	10:30	"	58	11¼	64	9½
"	11	"	58	11¾	64	10
"	11:30	"	59	—	64	10
"	12 Noon		59	¼	64	10½
"	12:30	P.M.	59	½	64	10½
"	1	"	59	½	64	10¾
"	1:30	"	59	¾	64	11¼
"	2	"	59	¾	64	11½
"	2:30	"	59	1	64	11¾
"	3	"	59	1	64	11¾
"	3:30	"	59	1¼	65	—
"	4	"	59	1½	65	—
"	4:30	"	59	1½	65	¼
"	5	"	59	1¾	65	½
"	5:30	"	59	2	65	¾
"	6	"	59	2¼	65	1
"	6:30	"	59	2½	65	1½

*Flood height February 18th, 1832.

Date.	Time.		1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 10—	7	P.M.	59	2½	65	1¾
"	7:30	"	59	2½	65	2
"	8	"	59	3	65	2¼
"	8:30	"	59	3	65	2½
"	9	"	59	3½	65	2¾
"	9:30	"			65	3
"	10	"	59	3¾	65	3¼
"	10:30	"			65	3½
"	11	"	59	4	65	3¾
"	11:30	"			65	4
"	12 Midnight		59	4¾	65	4¼
Feb. 11—	12:30	A.M.			65	4½
"	1	"	59	5¼	65	4½
"	1:30	"			65	4¾
"	2	"	59	6	65	5½
"	2:30	"			65	5¾
"	3	"	59	6¾	65	6
"	3:30	"			65	6½
"	4	"	59	7½	65	7
"	4:30	"			65	7½
"	5	"	59	8¾	65	8
"	5:30	"			65	8½
"	6	"	59	9¾	65	9
"	6:30	"	59	10¾	65	9¾
"	7	"	59	10¾	65	10
"	7:30	"	59	11¼	65	10½
"	8	"	59	11¾	65	11
"	8:30	"	60	¼	65	11½
"	9	"	60	1½	66	—
"	9:30	"	60	1¾	66	½
"	10	"	60	2½	66	¾
"	10:30	"	60	4	66	1¼
"	11	"	60	5	66	1¼
"	11:30	"	60	6	66	2½
"	12 Noon		60	7	66	2¾
"	12:30	P.M.	60	8	66	3
"	1	"	60	9	66*	4½
"	1:30	"	60	10	66	5
"	2	"	60	11	66	5½
"	2:30	"	61	½	66	6
"	3	"	61	1½	66	6½
"	3:30	"	61	2½	66	7
"	4	"	61	3½	66	7½
"	4:30	"	61	4	66	8½
"	5	"	61	5	66	9
"	5:30	"	61	6	66	9¾
"	6	"	61	8	66	10
"	6:30	"	61	8	66	10½
"	7	"	61	9	66	11
"	7:30	"	61	9½	66	11½
"	8	"	61	10	67	—
"	8:30	"			67	½
"	9	"	62	—	67	1
"	9:30	"			67	1½
"	10	"	62	1	67	2

* Above flood height February 15th, 1883.

Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 11—	10:30 P.M.			67	2½
"	11 "	62	2½	67	3
"	11:30 "			67	3½
"	12 Midnight	62	4½	67	4
Feb. 12—	12:30 A.M.			67	4¾
"	1 "	62	6	67	5¼
"	1:30 "			67	5¾
"	2 "	62	7	67	6½
"	2:30 "			67	7
"	3 "	62	8½	67	7¼
"	3:30 "			67	7¾
"	4 "	62	9½	67	8
"	4:30 "			67	8¼
"	5 "	62	10¾	67	8¾
"	5:30 "			67	9¼
"	6 "	62	11¾	67	9¾
"	6:30 "			67	10½
"	7 "	63	1	67	11
"	7:30 "	63	2	68	—
"	8 "	63	3	68	—
"	8:30 "	63	3¾	68	½
"	9 "	63	4¼	68	1
"	9:30 "	63	4¼	68	1½
"	10 "	63	4¼	68	1¾
"	10:30 "	63	4¾	68	2¼
"	11 "	63	5	68	2½
"	11:30 "	63	5¾	68	3
"	12 Noon	63	6¼	68	3½
"	12:30 P.M.	63	7	68	4
"	1 "	63	7¼	68	4½
"	1:30 "	63	7½	68	5
"	2 "	63	8	68	5
"	2:30 "	63	8¼	68	5½
"	3 "	63	8¾	68	6
"	3:30 "	63	9	68	6½
"	4 "	63	9	68	7
"	4:30 "	63	9¾	68	7½
"	5 "	63	10	68	8
"	5:30 "	63	10½	68	8¼
"	6 "	63	11	68	8¼
"	6:30 "	63	11½	68	8½
"	7 "	64	—	68	8¾
"	7:30 "			68	9
"	8 "	64	1	68	9¼
"	8:30 "			68	9½
"	9 "	64	2	68	10
"	9:30 "			68	10¼
"	10 "	64	2¾	68	10½
"	10:30 "			68	10¾
"	11 "	64	3½	68	11¼
"	11:30 "			68	11½
"	12 Midnight	64	4¼	69	—
Feb. 13—	12:30 A.M.			69	¼
"	1 "	64	5	69	1
"	1:30 "			69	1½
"	2 "	64	5½	69	1¾
"	2:30 "			69	2¼

Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 13—	3 A.M.	64	6¼	69	2½
"	3:30 "			69	3
"	4 "	64	7½	69	3¾
"	4:30 "			69	4
"	5 "	64	8	69	4¼
"	5:30 "			69	4½
"	6 "	64	8¼	69	5
"	6:30 "	64	8½	69	5½
"	7 "	64	8¾	69	6
"	7:30 "	64	9¼	69	6½
"	8 "	64	9½	69	6¾
"	8:30 "	64	10	69	7¼
"	9 "	64	10¼	69	7¾
"	9:30 "	64	10½	69	8
"	10 "	64	10¾	69	8¾
"	10:30 "	64	10¾	69	9
"	11 "	64	11	69	9¼
"	11:30 "	64	11¼	69	9½
"	12 Noon	64	11½	69	10
"	12:30 P.M.	64	11½	69	10¼
"	1 "	64	11¾	69	10½
"	1:30 "	64	11¾	69	11
"	2 "	65	—	69	11
"	2:30 "	65	—	69	11½
"	3 "	65	¼	69	11½
"	3:30 "	65	½	69	11¾
"	4 "	65	½	70	—
"	4:30 "	65	½	70	½
"	5 "	65	½	70	½
"	5:30 "	65	½	70	¾
"	6 "	65	1	70	¾
"	6:30 "	65	1	70	¾
"	7 "	65	1	70	1
"	7:30 "			70	1½
"	8 "	65	1	70	1¾
"	8:30 "			70	2¼
"	9 "	65	1	70	2¾
"	9:30 "			70	3¼
"	10 "	65	1	70	3¾
"	10:30 "			70	4½
"	11 "	65	1	70	5
"	11:30 "			70	5¾
"	12 Midnight	65	½	70	6½
Feb. 14—	12:30 A.M.			70	7
"	1 "	65	½	70	7½
"	1:30 "			70	8
"	2 "	65	½	70	8½
"	2:30 "			70	9
"	3 "	65	¼	70	9½
"	3:30 "			70	10
"	4 "	65	—	70	10¼
"	4:30 "			70	10¼
"	5 "	64	11½	70	10½
"	5:30 "			70	10¾
"	6 "	64	11¼	70	10¾
"	6:30 "			70	11
"	7 "	64	11	70	11½

Date.	Time.	1883. Ft.	In.	1884. Ft.	In.
Feb. 14—	7:30 "	64	11	70	11¾
"	8 "	64	10¼	71	—
"	8:30 "	64	10¾	71	—
"	9 "	64	10¾	71	—
"	9:30 "	64	11	71	—
"	10 "	64	11½	71	*¼
"	10:30 "	64	11¾	71	¼
"	11 "	65	¼	71	¼
"	11:30 "	65	¾	71	½
"	12 Noon	65	1½	*71	¾
"	12:30 P.M.	65	2	*71	¾
"	1 "	65	3	*71	¾
"	1:30 "	65	3¾	*71	¾
"	2 "	65	4½	71	½
"	2:30 "	65	5	71	½
"	3 "	65	6	71	½
"	3:30 "	65	7	71	½
"	4 "	65	7¾	71	½
"	4:30 "	65	8½	71	½
"	5 "	65	9	71	½
"	5:30 "	65	9¾	71	½
"	6 "	65	10½	71	½
"	6:30 "	65	11	71	½
"	7 "	65	11½	71	—
"	7:30 "			70	11¾
"	8 "	66	½	70	11½
"	8:30 "			70	11¼
"	9 "	66	¾	70	11¼
"	9:30 "			70	11
"	10 "	66	1¾	70	11
"	10:30 "			70	10¾
"	11 "	66	2¼	70	10½
"	11:30 "			70	10
"	12 Midnight	66	2¾	70	10
Feb. 15—	12:30 A.M.			70	9½
"	1 "	66	3¼	70	9¼
"	1:30 "			70	9¾
"	2 "	66	3	70	9¼
"	2:30 "			70	9
"	3 "	66	3½	70	8½
"	3:30 "			70	8¼
"	4 "	†66	4	70	7¾
"	4:30 "			70	7½
"	5 "	†66	4	70	7
"	5:30 "			70	6¾
"	6 "	66	3¾	70	6½
"	6:30 "			70	6
"	7 "	66	3½	70	5¾
"	7:30 "	66	3¾	70	5
"	8 "	66	3½	70	5
"	8:30 "	66	3¼	70	4½
"	9 "	66	3	70	4
"	9:30 "	66	2¾	70	3½
"	10 "	66	2½	70	3½
"	10:30 "	66	2½	70	3

* Flood height of 1884.
† Flood height of 1883.

Date.	Time.	1883. Ft.	In.	1884. Ft.	In.
Feb. 15—	11 A.M.	66	2½	70	2½
"	11:30 "	66	2¼	—	—
"	12 Noon	66	1¾	70	2
"	12:30 P.M.	66	1½	70	2
"	1 "	66	1¼	70	2
"	1:30 "	66	1	70	1
"	2 "	66	½	70	½
"	2:30 "	66	—	70	—
"	3 "	65	11¾	70	—
"	3:30 "	65	11½	69	11½
"	4 "	65	11¼	69	11¼
"	4:30 "	65	10¾	69	10¾
"	5 "	65	10¾	69	10¾
"	5:30 "	65	10¾	—	—
"	6 "	65	10¾	69	10¼
"	6:30 "	65	10½	69	10
"	7 "	65	9½	69	9½
"	7:30 "			69	9
"	8 "	65	8	69	8¾
"	8:30 "			69	8¼
"	9 "	65	6¾	69	7¾
"	9:30 "			69	7¼
"	10 "	65	5¾	69	7
"	10:30 "			69	6½
"	11 "	65	4¾	69	6¼
"	11:30 "			69	6
"	12 Midnight	65	3¾	69	5½
Feb. 16—	12:30 A.M.			69	5¼
"	1 "	65	2½	69	5
"	1:30 "			69	4¾
"	2 "	65	1½	69	4¼
"	2:30 "			69	3¾
"	3 "	65	½	69	3
"	3:30 "			69	2½
"	4 "	64	11¾	69	2
"	4:30 "			69	1
"	5 "	64	11	69	½
"	5:30 "			69	—
"	6 "	64	10	68	11
"	6:30 "			68	10½
"	7 "	64	9	68	10
"	7:30 "	64	8	68	9½
"	8 "	64	7½	68	9
"	8:30 "	64	7½	68	8½
"	9 "	64	6½	68	8
"	9:30 "	64	6	68	7½
"	10 "	64	5½	68	7
"	10:30 "	64	5½	68	7
"	11 "	64	4½	68	6¼
"	11:30 "	64	4½	68	5¾
"	12 Noon	64	4½	68	5½
"	12:30 P.M.	64	3	68	5
"	1 "	64	3	68	4½
"	1:30 "	64	2	68	4
"	2 "	64	2	68	3½
"	2:30 "	64	1½	68	3
"	3 "	64	½	68	2½

Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 16—	3:30 P.M.	64	—	68	2
"	4 "	63	11½	68	1½
"	4:30 "	63	10¾	68	1
"	5 "	63	10	68	½
"	5:30 "	63	10	67	11½
"	6 "	63	9½	67	11
"	6:30 "			67	11
"	7 "	63	9	67	10½
"	7:30 "			67	10
"	8 "	63	8	67	9½
"	8:30 "			67	9
"	9 "	63	6	67	8½
"	9:30 "			67	8
"	10 "	63	5	67	7½
"	10:30 "			67	7
"	11 "	63	4	67	6½
"	12 Midnight	63	3	67	6
Feb. 17—	12:30 A.M.			67	4¾
"	1 "	63	2	67	4
"	1:30 "			67	3¾
"	2 "	63	1½	67	2½
"	2:30 "			67	1¾
"	3 "	63	1½	67	1
"	3:30 "			67	½
"	4 "	62	11¾	66	11¾
"	4:30 "			66	11
"	5 "	62	11	66	10½
"	5:30 "	62	11	66	9¾
"	6 "	62	10	66	9
"	6:30 "	62	10	66	8½
"	7 "	62	9½	66	8
"	8 "	62	7	—	—
"	8:30 "			66	7
"	9 "	62	6	66	6
"	9:30 "			66	5
"	10 "	62	5½	66	4¼
"	10:30 "			66	4¼
"	11 "	62	5	66	3¾
"	11:30 "			66	3
"	12 Noon	62	4	66	2¼
"	12:30 P.M.			66	1¾
"	1 "	62	2½	66	¾
"	1:30 "			66	—
"	2 "	62	1¾	65	11½
"	2:30 "			65	11
"	3 "	62	1	65	10
"	3:30 "			65	9½
"	4 "	61	11½	65	9
"	4:30 "			65	8½
"	5 "	61	11	65	7½
"	5:30 "			65	6¾
"	6 "	61	10	65	6
"	6:30 "			65	5½
"	7 "	61	9	65	5
"	7:30 "			65	4½
"	8 "	61	8	65	4
"	8:30 "			65	3½
Feb. 17—	9 P.M.	61	7	65	2¾
"	9:30 "			65	2¼
"	10 "	61	6	65	1½
"	10:30 "			65	1
"	11 "	61	5	65	—
"	11:30 "			64	11½
"	12 Midnight	61	4	64	11
Feb. 18—	12:30 A.M.			64	10½
"	1 "	61	3	64	10
"	1:30 "			64	9½
"	2 "	61	2	64	9
"	2:30 "			64	8¼
"	3 "	61	1	64	7½
"	3:30 "			64	7
"	4 "	61	—	64	6¼
"	4:30 "			64	5½
"	5 "	60	11	64	4½
"	5:30 "			64	3½
"	6 "	60	10	64	2½
"	6:30 "			64	2
"	7 "	60	9¼	64	1½
"	8 "	60	8	63	11½
"	9 "	60	7	63	10½
"	10 "	60	6	63	9
"	11 "	60	5½	63	7
"	11:30 "			63	6½
"	12 Noon	60	5	63	5½
"	1 P.M.	60	4	63	5
"	1:30 "			63	3
"	2 "	60	3	63	2½
"	3 "	60	2	63	2
"	3:30 "			63	½
"	4 "	60	1	63	—
"	5 "	60	—	62	11
"	6 "	59	11	62	9½
"	6:30 "			62	8
"	7 "	59	10½	62	8
"	7:30 "			62	7
"	8 "	59	10	62	6
"	8:30 "			62	5½
"	9 "	59	9½	62	4½
"	9:30 "			62	4
"	10 "	59	9	62	3
"	10:30 "			62	2½
"	11 "	59	8½	62	1½
"	11:30 "			62	1
"	12 Midnight	59	8	62	—
Feb. 19—	12:30 A.M.			61	11
"	1 "	59	7½	61	9½
"	1:30 "			61	8½
"	2 "	59	7	61	8
"	2:30 "			61	7½
"	3 "	59	6½	61	6½
"	3:30 "			61	6
"	4 "	59	5¾	61	5
"	4:30 "			61	4½
"	5 "	59	5	61	3

Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 19—	5:30 A.M.			61	2½
"	6 "	59	4	61	2
"	6:30 "			61	1
"	7 "	59	3	61	—
"	7:30 "			60	11
"	8 "	59	3	60	10½
"	9 "	59	3	60	9
"	10 "	59	2	60	7½
"	11 "	59	1	60	6
"	12 Noon	59	—	60	4
"	1 P.M.	58	11½	60	3
"	2 "	58	10½	60	1
"	3 "	58	9½	60	—
"	4 "	58	9	59	11
"	5 "	58	8	59	10½
"	6 "	58	8	59	10
"	7 "	58	8	59	9½
"	8 "	58	7	59	9¼
"	9 "	58	6	59	9½
"	10 "	58	5	59	9½
"	11 "	58	5	59	9
"	12 Midnight	58	4½	59	8½
Feb. 20—	1 A.M.	58	4	59	7½
"	2 "	58	3½	59	7
"	3 "	58	3	59	6½
"	4 "	58	2½	59	6
"	5 "	58	2	59	5½
"	6 "	58	1½	59	5
"	7 "	57	10	59	4
"	8 "	57	10	59	3½
"	9 "	57	10	59	3
"	10 "	57	9	59	2
"	11 "	57	8	59	1
"	12 Noon	57	7	59	—
"	1 P.M.	57	6½	58	11
"	2 "	57	5½	58	9
"	3 "	57	5	58	8
"	4 "	57	4	58	7
"	5 "	57	3½	58	6
"	6 "	57	3	58	5
"	7 "	57	2	58	4
"	8 "	57	1	58	2
"	9 "	57	½	58	—
"	10 "	57	—	57	10
"	11 "	56	11½	57	8
"	12 Midnight	56	11	57	6
Feb. 21—	1 A.M.	56	10½	57	4
"	2 "	56	10	57	2½
"	3 "	56	9¼	57	1
"	4 "	56	8½	57	—
"	5 "	56	7	56	11
"	6 "	56	6½	56	9½
"	7 "	56	5	56	7½
"	8 "			56	5½
"	9 "	56	4½	56	4
"	10 "	56	½	56	2½
"	11 "	55	11	56	—

Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 21—	12 Noon	55	10	55	10
"	1 P.M.	55	9	55	8
"	2 "	55	8	55	7
"	3 "	55	7	55	5
"	4 "	55	6	55	4½
"	5 "	55	5	55	1½
"	6 "	55	4	54	11
"	7 "	55	3	54	10
"	8 "	55	2	54	9
"	9 "	55	1	54	7½
"	10 "	55	—	54	5½
"	11 "	54	11	54	3½
"	12 Midnight	54	10	54	1
Feb. 22—	1 A.M.	54	9	53	11
"	2 "	54	8	53	9
"	3 "	54	6	53	7
"	4 "	54	4½	53	4½
"	5 "	54	3	53	2½
"	6 "	54	1½	53	½
"	7 "	53	11	52	10½
"	8 "	53	10	52	9
"	9 "	53	9	52	8
"	10 "	53	8	52	6½
"	11 "	53	7	52	4½
"	12 Noon	53	6	52	2½
"	1 P.M.	53	5	52	½
"	2 "	53	3½	51	10½
"	3 "	53	2	51	9
"	4 "	53	1	51	7½
"	5 "	53	—	51	7½
"	6 "	52	11	51	5
"	7 "			51	2
"	8 "			51	—
"	9 "	52	4	50	10½
"	10 "			50	9
"	11 "			50	7
"	12 Midnight	51	10	50	5
Feb. 23—	1 A.M.			50	4
"	2 "			50	2
"	3 "	51	6	50	½
"	4 "			49	11
"	5 "			49	9½
"	6 "	51	1	49	8
"	7 "			49	6
"	8 "			49	4
"	9 "	50	—	49	2
"	10 "			49	—
"	11 "	49	8	48	10
"	12 Noon	49	6	48	8
"	1 P.M.	49	4	48	6
"	2 "			48	4
"	3 "	49	1	48	2½
"	4 "			48	—
"	5 "			47	11
"	6 "	48	7	47	10
"	7 "			47	9
"	8 "			47	7½

Date.	Time.	1883. Ft.	In.	1884. Ft.	In.
Feb. 23—	9 P.M.	48	3	47	6
"	10 "			47	4
"	11 "			47	2
"	12 Midnight	47	9	47	—
Feb. 24—	1 A.M.			46	10
"	2 "			46	9
"	3 "	47	—	46	7½
"	4 "			46	6
"	5 "			46	4½
"	6 "	46	4	46	3
"	7 "			46	2
"	8 "			46	½
"	9 "			45	10½
"	10 "			45	8½
"	11 "			45	7
"	12 Noon	45	1	45	5
"	1 P.M.			45	3
"	2 "			45	1½
"	3 "			45	—
"	4 "			44	10½
"	5 "			44	9
"	6 "	44	—	44	7½
"	7 "			44	4½
"	8 "			44	2½
Feb. 24—	9 P.M.			44	—
"	10 "			43	10
"	11 "			43	8
"	12 Midnight			43	6
Feb. 25—	6 A.M.	42	8	42	10
"	7 "			42	—
"	8 "			41	10
"	9 "			41	7½
"	10 "			41	5½
"	11 "			41	3
"	12 Noon	42	1	41	1
"	6 P.M.	41	2	40	2
Feb. 26—	6 A.M.	39	11	38	1
"	12 Noon	37	11	37	1
"	6 P.M.	37	—	36	—
Feb. 27—	6 A.M.	34	10	34	1
"	12 Noon	34	5	33	2
"	6 P.M.	33	10	33	—
Feb. 28—	6 A.M.	32	4	30	3
"	12 Noon	31	10	29	7
"	6 P.M.	30	2	28	4
Feb. 29—	6 A.M.			27	3
"	12 Noon			25	6
"	6 P.M.			25	—

THE FUCOIDS OF THE CINCINNATI GROUP.

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Read and referred to Publishing Committee, September 2, 1884.

The induction philosophy of Lord Bacon is the guiding philosophy of science. This scientific method teaches us to argue from particulars to generals; from the known to the unknown. So that, before attempting to investigate the conditions of the past, something should be known about those of the present. He who would argue about the substance of the moon without knowing something of the composition of the earth, would not deserve the confidence nor merit the hearing of his fellows. So he who would argue about the formation of rocks, without a knowledge of the manner of the deposition of sediment at the present day, should meet a similar fate.

It has been generally acknowledged by geologists, at least by those of the uniformitarian school, that the changes on the earth's surface have been gradual. All the introductions and extinctions of animal forms have come slowly. Rivers have carved their beds, and mountains have been elevated by slight degrees. The majority of changes, however vast, have been produced by such agents as are at present modifying the surface of the earth.

These agents and their effects being the same, it is possible, by studying what is going on in the present age, to picture what went on in past ages. Rain fell as it falls on the earth and washed it away. Water held the sediment and deposited it in the same way then that it does now. Rivers rose and fell. Tides ebbed and flowed. Their effects were the same. Sediment was left on the retiring of the waters of rivers, and on the ebbing of the tide. So that as far as the aqueous forces are concerned, their effects may be regarded the same ten million years ago as they were only ten years ago.

But while the physical agents were unchanged, and their effects were as they still are, the forms of life have undergone a complete and entire revolution. Not a single creature is identical with its forerunners of the Silurian and Carboniferous epochs. Yet, though neither the species nor the genera are identical or hardly similar, the general types are much the same. Corals, echinoderms, lamellibranchs, gasteropods, annelids, crustaceans, all frequented the Palæozoic seas. All of them have left their remains in the rocks in abundance; sometimes so plainly, that there can be no doubt as to their character; at other times so imperfectly, as to be difficult of determination. And while many students have observed these remains, the observations have not been made as they might have been. The idea seems to have been that every mark was made by a living thing, or was the remains of a species. Sufficient attention does not seem to have been paid to the varying conditions of life, nor to the natural forces then active. It is the object of the present paper to call attention to, and show the true character of, certain marks found in the rocks of the Cincinnati group which have previously been regarded as organic.

CHARACTER OF FUCOIDS.

The term "fucoid" is one which has been used by palæontologists in the most indefinite way. It has been applied to all sorts of markings, and, like charity, covers a multitude of sins. Almost every obscure or undeterminable form has been called a "fucoid," or has been said to be made up of "fucoidal matter." Abused as the word has been, it has come at last to have none of its original significance, and should either be restricted to what are strictly remains of seaweeds, as the term implies, or else discarded altogether. The latter would, perhaps, be the better course, and the word Algæ substituted in its place. But, at the same time, care should be taken that none but what are the remains of Algæ should be referred to the class.

As this order of plants is known now, there are few indeed, of them that

are likely to be preserved as fossils.* Consisting, as they do, of thin cellular, membraneous tissue, sometimes with a central rib, sometimes lacking it; with or without a stem; sometimes coarse and sometimes formed of delicate thread-like fibers, there are comparatively few which seem to be capable of preservation. There is no reason to suppose that the ancient progenitors of the Algæ were more likely to be preserved than are the modern prototypes; and it should be considered rather a matter of surprise to find any in a fossil state, than a thing to be expected. The fact is, that the majority of the remains which have been called "fucoids," and thus referred to the Algæ, are not plants at all, and are in some cases not even of an organic nature. When such is the case, and when mud marks, annelid trails, burrows, trails of gasteropods and lamellibranchs, and casts of articulate tracks have been called fucoids, it is time to investigate the state of affairs, and endeavor to settle the disputed question as to what shall be called Algæ and what not.

There can be no possible objection to describing and figuring the trails, tracks or burrows of animals which lived in long past ages as long as they are considered *as* trails or burrows. But there is considerable objection to calling them and referring to them as Algæ, when they have no connection whatever with plants. The rocks of the Cincinnati group and the Clinton group are full of markings of various sorts, much more so in fact than the higher formations. As they are generally of an obscure and indefinite character, they have been either largely overlooked, or else studied in a careless and superficial manner. For while corals, crinoids, mollusks and crustaceans have been carefully studied, the large field occupied by the above-mentioned markings has been disregarded. Yet they are at the same time valuable as showing one very important thing, and that is, that the conditions of nature were the same, or very similar, to those we find at present.

* NOTE.—In regard to the preservation of Algæ in modern times, Lesquereux, in the Thirteenth Annual Report of the State Geologist of Indiana, 1883, Part II., p. 26, says: "When rapidly decomposed under atmospheric influences, the marine plants pass to a fluid state, or when coriaceous, they are dissolved under the alternate action of dryness and humidity. The heaps of wrack, or of hard species of marine Algæ thrown upon the beach by the waves, do not become compact and dry, and can never be used for fuel, like peat; they gradually pass at the base of the banks into a half-fluid matter, which percolates through the sand." Now it is a peculiarity of the remains which have been referred to "fucoids," that they are found on what were sea-beaches, where they would be exposed to the "alternate action of dryness and humidity," and, therefore, be little likely to be preserved. The assertion that they were exposed on sea-beaches will be referred to later on and proved.

MODERN MUD MARKINGS.

As preliminary to a consideration of these fossil marks, it will be necessary to study some of the markings found on the mud banks of rivers, or on ocean beaches when the tide has ebbed. The tracks or marks produced by animal forms will naturally be different now from what they were during the Silurian age. But those produced by natural causes simply, as, for instance, the action of rain or the water of rivers on mud, or by the daily ebb and flow of the tide, may be considered as at least similar, both then and now.

Some of these marks have been observed on sea beaches by Sir Charles Lyell. In his "Prin. of Geol." (Vol I., p. 327), he remarks, in reference to impressions of rain-drops on the mud flats of the Bay of Fundy, as follows: "When a shower of rain falls, the highest portion of the mud-covered flat is usually too hard to receive any impressions; while that recently uncovered by the tide near the water's edge is too soft. Between these areas a zone occurs almost as smooth and even as a looking-glass, on which every drop forms a cavity of circular or oval form; and if the shower be transient, these pits retain their shape permanently, being dried by the sun, and being then too firm to be effaced by the action of the succeeding tide, which deposits on them a new layer of mud. Hence we find on splitting open a slab an inch or more thick, on the upper surface of which marks of rain occur, that an inferior layer, deposited perhaps ten or twelve tides previously, exhibits on its under surface perfect casts of rain prints which stand out in relief, the molds of the same being seen in the layer below."

Precisely the same thing can be seen on the muddy banks of rivers after a flood, and when a shower of rain falls before the mud is entirely dry. My own observations show that the impressions are large, circular and distinct. (Plate V., figure 1.) If the shower was only a light one, the impressions remain distinct and separated. But if heavy, they are more or less irregular; and in the case of very heavy rains they become entirely obliterated, and the surface is marked with many rills along which the water has run; and on a gentle slope a larger channel will carry off the water to the main stream, or into some depression. On quite soft mud, close to the edge of the stream, the impressions are never so distinct. The same impressions and casts referred to by Lyell, I have seen on splitting open slabs of mud which had dried on the shore.

FOSSIL MUD-MARKINGS.

If such are the effects of rain on modern mud banks, the inference is just that if similar markings are found in the rocks, they were produced by similar causes. Like causes produce like effects; so that, as specimens of rock have been found containing impressions like these rain-drops, it may be considered that they were made in the same way. Dr. Dawson, in "Acadian Geology," p. 27, figures rocks from the Carboniferous with rain-drop impressions. Lyell, in "Travels in America" (first visit), Vol. II., p. 140, refers to similar ones from the red sandstone of New Jersey; and quite recently Mr. U. P. James has found in Clinton County, Ohio, in strata of the Cincinnati group, exactly similar markings, as shown in Plate V., figure 2.

The inferences from these facts are evident. The marks could have been made in no other way than on mud beaches alternately bared and covered by the tide. And if this is the case, it becomes proof positive that part of the strata, at least, was deposited in shallow water or on the margin of the ocean. It has been thought that the strata of this group were deposited in deep water, but facts are known now which are sufficient to prove the reverse. Some of these will be given presently.

CLASSIFICATION OF THE FUCOIDS.

The fossils which have been referred to fucoids may be classified under three different heads: 1. Mud marks, concretions or rain marks; 2. Tracks or trails of annelids, mollusks or crustaceans; 3. Probable Algæ. Of these, the last are the least and the second are the most numerous Taking them in order, mud marks, and so on, come first under consideration.

FUCOIDAL MUD MARKS.

Next to the rain-drops on mud flats or banks come mud bubbles. These are often seen—sometimes perfectly circular, one-half to three-quarters of an inch in diameter, and are of liquid mud, strong enough to stand considerable pressure without bursting. (Plate V., figure 3.) These are represented in the rocks of the Cincinnati group by a form which has been described as a fucoid under the name of *Discophycus typicalis*, Walcott, "Trans. Alb. Inst.," Vol. X., p. 19; (Plate V., figure 4.) This is described as being almost circular, flat, and with a corrugated or furrowed edge, as if a rather succulent material had been wrinkled under pressure. In the strata of the Utica slate, sometimes considered as Cincinnati group, another form was described by Walcott (in "Trans. Alb. Inst.," Vol. X., p. 19) as *Cyathophycus subsphericus.* (Plate V., figure 5.) The apex of this has

sometimes been found burst, and the edges of the aperture torn irregularly. It seems most likely that these so-called fucoids are, in reality, fossilized mud bubbles. All appearances indicate it; and, if so, they can scarcely be considered worthy of generic and specific names. It seems wiser to altogether discard these species and look upon them as ancient relics of gaseous formation of the Silurian age.

Another sort of a mud mark which has been called a fucoid, is sometimes found covering large slabs with long, straight lines, occasionally bulging out in certain spots. Examining the recent mud flats, precisely similar appearances are seen. (Plate V., figure 6.) They are caused often by a small stick or stone, or even the body of an insect lodging on the mud, and causing the current to break and flow to each side and depositing a streak of mud behind it. Some of these specimens have been referred to *Scolithus linearis* (Hall), but erroneously; for this species of Hall's comes under the second head, that of burrows, and it has probably not been found in the Cincinnati group.

Still another sort of mud mark has been formed in a curious way. Along the edges of streams, on the retiring of the waters of a flood, there are often little shallow pools filled with muddy water. The edges of these pools, as they dry, assume irregular shapes, and the mud is often deposited in such a manner as to retain this shape. (Plate V., figure 7.) Sometimes it forms an irregular semi-circle, and as the mud in the depression is of a lighter color than that outside, it becomes quite conspicuous. A figure (Plate V., figure 8) is given in "Pal. of New York," Vol. II., Plate 11, very like the one here shown; and Prof. Hall said of the one he figured, that though it had different features than ordinary wave lines, it might be due to inorganic causes. A still more remarkable one, and quite as certainly a mud splash, is in the collection of this Society, and was found near Covington, Ky. It is here shown (Plate V., figure 9) to compare with the mark of known origin, and comparison is all that is necessary to note the resemblance.

The washing of water against the bank of a stream often produces ripple marks which extend along the shores for some distance in regular, undulating lines. One layer deposited on another to a thickness of several inches gives an appearance like stratification; and, as similar appearances are presented in some of the rocks of this vicinity, they have been described as organic under the name of *Palæophycus flexuous* (James). (Plate VI., figure 1.) On calling the attention of the describer of the fossil to the recent marks, he at once admitted their similarity, and acquiesced in the suggestion that their origin in each case was the same.

The heavy dashing of rain on the surface of mud will often make irregularly arranged elevations and depressions, with often a little channel leading the superfluous water to a lower level. This washing will frequently give the surface of the soil an appearance very remotely resembling the branches of a plant, and the cast will often be more misleading than the marks themselves. Pieces of mud found in a fossil state having such markings on them, have led to the establishment of a genus of so-called fucoids under the nāme of *Aristophycus.* It was first described and figured by Miller and Dyer, in No. 2 of "Contri. to Pal." (pp. 3, 4). One species, *A. ramosum* (Plate VI., figure 2), and a variety, *germanum*, were described. The species is described as consisting of a stem which divides and subdivides in an irregular manner. "The ramifications are sent off," say the authors, "like the roots of a tree or shrub, without any determinate order, while many of the smaller fibers inosculate like the veins in the leaf of a tree." The variety differs from the species in having more numerous and smaller branches. Neither one can be considered as entitled to a name of any kind. There are no characters upon which to base the assertion that it was a plant, and every indication that it was made by rain on the surface of mud as before intimăted. The same features may be seen on any muddy surface after a moderately heavy rain.

On other places of a mud flat, other indications of the action of water are to be seen. On gently sloping banks small lateral rivulets will be seen running into large ones, and these large ones into others still larger. The smallest and the branch into which they run often assume a feather-like form, the main channel representing the shaft and the small lateral ones the web of the feather.

From rocks of the Cincinnati group there has been described a genus with the name of *Chloephycus.* It was established by Miller and Dyer, in "Contri. to Pal.," No. 2 (p. 3), and one species (*C. plumosum*) was figured and described. (Plate VI., figure 3.) The figure and the description, and the specimens themselves, indicate the character of the fossil. It is nothing more than a mark, or a series of marks, produced in the way already described by the running of water down a sloping bank into a stream.

If these channels, with their lateral branchlets in the mud, were enlarged, a deeper channel would result. If a cast were then taken from the depression, it would be rounded on one side and flat on the other. The rounded side would be marked with lines running from the center toward the edge, or overlapping irregularly along it. Now, the genus *Trichophycus* was founded by Miller and Dyer, in "Contri. to Pal.," No. 1

(JOUR. CIN. SOC. NAT. HIST., Vol. I., p. 24), and made to include certain "fucoids" having cylindrical stems with diagonal or longitudinal markings, as if hair-like filaments had been pressed down flat on the stem. The *T. venosum* was described by S. A. Miller, in JOUR. CIN. SOC. NAT. HIST., Vol. II., p. 112, and there figured. Dawson, in "Acadian Geology" (p. 27), figures a specimen of what he calls "rill-marks" (Plate VI., figure 4) from the Carboniferous, formed in some such way as can be seen on mud banks now, and *Trichophycus venosum* is evidently of similar origin. The describer of it says that the plant "consists of a half-cylindrical stem, covered on the cylindrical surface with irregular and inconstant elevated lines," which vary from longitudinal to "diagonally radiating from a central line." The description of the fossil corresponds so very well with the recent mud mark, that there can scarcely be a doubt as to their having been made in the same way. Another species of the same genus—*T. sulcatum* (Plate VI., figure 5)—was described by M. and D., in "Contri. to Pal.," No. 2 (p. 4). This is also a fossil rill-mark. For while the surface is longitudinally furrowed, these "furrows are not regular in their size, nor in their course. Sometimes the larger ones are running parallel to each other; at other times several smaller ones intervene." In fact, both figure and description indicate that here again is a fossil with a name which it does not deserve, and which is without question a mark of inorganic character.

As long ago as 1852, Prof. James Hall figured in "Pal. of New York," Vol. II., some fossil remains which he considered as roots or parts of marine plants. Among them (on Plate XI.) is a figure of a peculiar dumb-bell fossil. (Plate VI., figure 6*a*.) This he did not venture to name; but in 1874 Dr. Billings, in "Pal. Foss. of Canada," Vol. II., figured a similar form which he called *Arthraria antiquata* (Plate VI., figure 6*b*), coining the new genus for the reception of the one species. There is no mistaking the form in its resemblance to that of Prof. Hall's, and there can be no question but that they are both the same. In 1875, in *Cin. Quar. Jour. Science*, Vol. II., p. 354, Mr. S. A. Miller described a species of *Arthraria* under the name of *A. biclavata*. His figure shows perfectly round balls at the ends of a wonderfully symmetrical stem, such as would hardly be found. Still, a great variation is to be detected in the shape and size of different specimens. Some are round, some square, some rough at the ends. (Plate VI., figure 6*c*.) In many cases all that remains of them is a depression in the rock, the whole substance having been dissolved. Were species to be distinguished on the form alone, every

specimen would be a different species. It is therefore better, if it be considered a species at all, to regard all the forms as one.

As none of these three figures—Hall's, Billings' or Miller's – show any signs of structure, and as neither Billings' nor Miller's descriptions give any indication that the fossil possessed any, it is difficult to say why it should be considered as an Alga, or, in fact, an organism of any sort. As the differences between Billings' and Miller's descriptions are immaterial, there can be no doubt but that the *A. biclavata* is a synonym of *A. antiquata*, and should be so regarded. There being no structure exhibited, and though the form is constant, yet it seems more probable that it is a concretion than that it is organic. This is here thrown out as a suggestion.

These, then, may be regarded as the products of the action of water upon mud, and the result is that eight so-called species and one variety disappear altogether. These species are: Aristophycus ramosum, M. & D.; Var. germanum, M. & D.; Arthraria antiquata, Billings; (A. biclavata, S. A. M.); Discophycus typicalis, Walcott; Cyathophycus subsphericus, Walcott; Palæophycus flexuosus, James; Trichophycus venosum, S. A. M.; Trichophycus sulcatum, M. & D.; Chloephycus plumosum, M. & D.

[TO BE CONCLUDED.]

THE VILLAGE INDIANS OF NEW MEXICO.

By James W. Abert.

Read before the Society, September, 1884.

These interesting people have always awakened great thought and study in the minds of ethnologists, on account of their attainments in civilization as well as the intimate relations they seem to bear to that mysterious pre-historic race whom we designate as the Mound Builders.

From the days of Francisco Coronado, these Pueblo Indians have been noted for their peculiar characteristics, so different from other tribes of Indians. They are sober, industrious and conspicuous for morality and honesty. Cannibalism and human sacrifice were nowhere found among them.

When I visited New Mexico in 1847, there were twenty Pueblo villages still inhabited, numbers depopulated and in ruins, and many, of which the Indian population had been supplanted by the Spanish race.

The whole population of the Pueblos, as given by the U. S. Census, is

7,867. The population of these villages never could have been very large, for the agricultural land in their vicinity could never have furnished means of subsistence for a much larger population in each town.

Their habits have been much modified by intercourse with the Spanish and American races. In early times they used to dress in garments made of the black seed-cotton, which is indigenous—now they dress chiefly in woolen garments of their own weaving.

In this paper I purpose to speak chiefly of their architecture. Many of its characteristic features are peculiar to the structures of all semi-civilized people.

Their buildings have flat roofs, small windows, originally no fireplaces, no openings or doors on the ground floor, ladders to ascend to the second story, communal houses, buildings on the rectangular system, open court-yards, houses on three sides closed in by a wall on the fourth side, towns oriented, "corrals," or circular inclosures near the town for sheltering cattle and sheep.

These corrals, in the days of the "conquistadores," were used to contain tame buffalo, deer and antelope—which with poultry, consisting of tamed turkeys, partridges and ducks, formed a good part of the subsistence of the Pueblos.

Their houses are generally but three stories high—three rooms deep on the first floor, two on the second and one on the third floor—so that the cross-section presented the form of a flight of three steps.

The Pueblo of Taos (Ancient Braba) contained houses five stories high. A small creek divided the town, but the houses were connected by a bridge.

Of their ruined towns, Hungo Pavie was 300 feet by 144 feet. It contained 144 rooms about 12 feet square, with estufas for religious ceremonies, and possessed a population of 800 souls.

The Pueblo Bonito contained 641 rooms.

Castenada, who accompanied the expedition of Francisco Coronado to New Mexico in 1540–42, estimated the population of the fourteen villages of Cibola and Tucayan at four thousand men, probably warriors, and that of the numerous villages on and near the Rio Grande and its tributaries at sixteen thousand souls.

In the works of Bernal Diez you will find a drawing of a Temple of Mexico, which possesses all the characteristic features of the dwellings of the Pueblo Indians.

The Temple of Mexico, at Cholula, was four stories high: the Temple of the Sun 221 feet high; the Temple of the Moon 144 feet high. They

were built of sun-dried brick, faced with stone and covered with hard cement. The lesser pyramid contained a passage-way which descends at an angle of 30°. In this respect it resembled the great Pyramid of Cheops.

One of the most interesting villages that I visited is called Acoma. It is situated on the headwaters of a stream which empties into the Rio del Norte, and was first described by Nunez Cabeça de Vaca in 1536.

Acoma is located upon the top of a high, flat rock, whose sides rise vertically out of the surrounding plain to the height of 300 feet.

The top of the rock embraces an area of ten acres. Here you find a tank for water, which is 150 feet by 20 feet and 5 feet in depth.

The population of Acoma is 350. It is 80 miles east of Zuñi and 50 miles west of the Rio Grande. The houses are built of adobes. As you go further south you find the Pueblos begin to use rough stone; and the Indians of Mexico and Yucatan used dressed stone.

Wooden lintels were used for door and windows, and over some small windows are found stone lintels of 18 inches in length.

Mr. Albert Gallatin believed that the civilization of New Mexico was derived from the South. He says "The agriculture of New Mexico did not originate here and was not thence transferred northwardly; the very reverse is the case." Again he says: "The civilization of the Gila and New Mexico was not of native growth; it appears most certain that it could not have been introduced from either the east, north or west. In either of these directions those people were surrounded by wild nations, in the hunter state, and cultivated nothing." As we all know, both the maize and the cotton belong to semi-tropicalregions.

We would now attempt to classify the different styles of architecture possessed by the indigenous races of North America.

1. The square, hewn stone structures of the people of Yucatan, the City of Mexico and the neighboring regions.

2. The square, adobe communal buildings of the Pueblo Indians of New Mexico, Colorado and Arizona.

3. The round, mound-shaped dirt dwellings of the Mandans and Minitarees.

4. The birch-bark wigwams of the Winnebagoes and Chippewas.

5. The conical tent dwellings of the nomadic tribes.

6. The rude shelters of accidentally occurring materials, such as are used by the Digger Indians.

1. The most civilized of our North American races were ignorant of the groined arch, the cylindrical arch, and of the simple circular arch for

doorways and windows. The buildings found in Mexico by Cortez consisted of "teocalli" temples erected on mounds, each story narrower than the one immediately beneath it, so that they seemed to recede as you ascend, like steps of a stairway.

Dressed stone was used in constructing their buildings. They possessed hard copper tools capable of cutting the hardest stone, and the carving of their idols and of such stones as the great Calendar Stone of the City of Mexico demonstrates their skill in handling the stone-cutter's chisel.

The pointed arch is seen in the "House of the Nuns," at Uxmal. In this kind of arch a core was first filled up solid, and this material was afterward removed when the cement had hardened. This pointed arch was noticed in New Mexico by Genl. J. H. Simpson, U. S. Army.

2. The Indians of our Pueblos build their houses three or four stories high of "adobes;" they are communal houses placed so as to surround an open court-yard or "plaza;" each story recedes the width of one room, and has a low parapet wall for defense along the upper edge of the first story. The exterior face or wall of these blocks of houses presents a single vertical face, and no openings near to the ground. There are no doors to the first story, so that one is forced to ascend to the second floor by the means of ladders in order to gain admittance. In time of attack by an enemy the ladders are drawn up, which would render the town inaccessible to any Indian force.

The division walls between adjacent houses are oftentimes sloped at an angle of 45 degrees and cut into steps, so the inhabitants may ascend to the highest of their flat roofs, which are used for drying meats, fruits and vegetables, also for sleeping places in warm weather.

3. The Mandan dwellings are large communal houses of circular form, the foundations sunken from two to three feet in the ground. The interior is from 40 to 50 feet in diameter; four large posts about 15 feet high stand near the center to support cross pieces, upon which the rafters are laid; the posts of the walls of the circumference, twelve in number, are about five feet in height; a circular opening is left in the center of the roof for the exit of smoke; a square door gives access to the dwelling. The whole structure is covered, both sides and roof, with from two to three feet of earth.

Dr. F. W. Langdon tells me that many ruins of such structures are found along the Miami River, and Catlin has traced the Mandans by their ruined houses down the Ohio to Cairo, and up the Mississippi and Missouri Rivers to the mouth of the Yellowstone River.

4. The framework wigwams, such as are constructed by the Winne-

bagoes and Chippewas. They are made by forming a skeleton structure of saplings, which constitute a rectangular framework with a cylindrical roof, and the whole is covered with sheets of birch bark, tied fast to the saplings with withes of bark. Close around the foot of the interior walls are raised platforms about six feet wide and six inches high—upon these the inmates sleep. The Indian mothers have posts driven in the ground, to which are swung hammocks for their babies. Fires for warmth and for cooking are built near the center of the room, and a hole in the roof allows the exit of the smoke.

5. The conical tent dwellings of our nomadic Indians are formed of lodge poles—their smaller ends meeting together for the vertex of the cone. Their but-ends are arranged on a circle of from 10 to 15 feet diameter. The exterior is covered with skins of wild animals, from which the hair has been removed.

The door is changed to the leeward, so as to avoid the cold winds and driving rain or snow. A chimney-hole is left at the top. The fire, with a tripod to hold the meat pot, is located in the center.

Some lodges, as among the Comanches, are thatched with wild grass.

6. Indians, such as our Digger Indians, and war parties, use whatever they find available for the purpose of shelter; old roots and limbs of trees are twisted together, forming a dome-shaped structure. Caves are scooped out of bluff clay banks.

The Indians of New Mexico frequently erect circular walls of rough stone, which are sometimes covered with boughs, or logs or skins; here the wily savages can lurk and watch for their enemies, spying from between the stones, which to the passer-by look like a simple pile of rough rocks.

The Mound Builders, in regard to their architectural attainments, I would place between the Pueblo Indian who builds his three-story houses of adobes, and the Mandan Indian who builds his circular, mound-like dwelling of wooden posts with clay-covered roof.

As regards the vast mounds erected by the Mound Builders, they were superior in the grandeur of their monumental structures to either the Pueblo Indian or the Mandan, as is shown by the great mound at Cahokio, Ill., which contains twenty million cubic feet of earth.

Whether I am right or wrong in my conjectures, I hope, at all events, that this attempt to classify the works of our Indians may awaken interest and inquiry in the minds of others, who may be induced to carry out the needful investigations in regard to the ethnology and archæology of the Pueblo Indians.

DESCRIPTIONS OF FOUR NEW SPECIES OF FOSSILS FROM THE CINCINNATI GROUP.

BY U. P. JAMES.

(Read June 3, 1884.)

GENUS MONTICULIPORA, D'ORBIGNY.

MONTICULIPORA OHIOENSIS, Sp. nov.

(Plate VII., figures 1 and 1a.)

THE numerous fragments found of the corallum of this species vary greatly in size and particular outline. The stems and branches are mostly cylindrical or sub-cylindrical, but sometimes slightly flattened, especially at places of branching. The branches are frequent and irregular, both as to distance apart and angle, but generally dichotomous. Some specimens (rarely) have a tumid form. (See figure 1a.) The surface is occupied by numerous conspicuous, elevated, rounded monticules, arranged in a somewhat alternate manner, averaging about one-twentieth of an inch in diameter at the base, and a little over or the same distance apart. The surface shows two series of tubes, with tolerably thick walls at the apertures; the larger are circular or sub-polygonal, with eight to ten calices in the space of one-tenth of an inch; the smaller, which are numerous, are round or angular. The calices on the monticules do not vary in size or shape from those occupying the general surface. The size of specimens vary from about three-twentieths of an inch in diameter to twelve-twentieths, and in some cases across the flattened portions at points of branching over one and one-fourth inches. (See figure 1.)

Longitudinal sections cut through the center of the stems show the tubes as having but a slight outward inclination in the axial region, but they soon curve abruptly at right angles and take a direct course to the surface; the walls of the tubes are thin and wavy in the center, but become decidedly thickened, and, apparently, somewhat fused together immediately outside of the sharp curve. The tabulæ in the axial portion are few or wholly wanting; but after the tubes curve and approach the surface the tabulæ become numerous, passing directly across the tubes, from wall to wall; the small interstitial tubes are no more closely tabulate than the larger, as far as observed. A transverse section shows the ends of the tubes, in the axial region, as thin-walled and polygonal in shape; but outside of the abrupt curve the tube walls are seen to be thickened, in long section. A tangential section shows the larger tubes to be irreg-

ularly rounded, and the smaller "interstitial" ones of various shapes, and a few of what may be "spiniform corallites" or hollow tubuli.

In the feature of the numerous interstitial tubes, and thickened walls of the outer portion of the corallites, as seen in long section, and the appearance of the tangential section, this species resembles M. *ulrichi* Nichn, but in all other features it is materially different, especially in the prominent, conspicuous *monticules*, and tabulation of the two sets of corallites. Prof. N. says, in regard to M. *ulrichi:* "*The surface is smooth and destitute of monticules,*" and that the interstitial tubes are "*much more closely tabulate*" than the larger corallites, which is not the case in M. *ohioensis.* Another decided difference, not so important perhaps, is the much more robust habit and larger size of specimens of *ohioensis* than *ulrichi.*

Position and locality: Cincinnati Group: Upper side of Columbia Avenue, Cincinnati, about 200 feet above low water mark of the Ohio River. It may be found at other localities—probably is—but this is the one where the writer found the type forms, and many variable duplicates.

Monticulipora falesi, Sp. nov.

(Plate VII., figures 2 to 2d.)

The corallum of this species varies in outline from an oval base and low, convex upper surface to a round base and steep, conical slopes to a small, circular apex. (See figures 2 to 2d) The specimens with low and moderately elevated convex upper surface seem to be young individuals. (Figures 2a to 2d.) The base margins are quite thin and sharp. The surface is occupied by circular and polygonal calices and stellate maculæ. The maculæ are irregularly distributed over the surface, and very little —some not at all—raised above the general surface. Walls of tubes thin at the aperatures. There are about seven or eight calices to one-tenth of an inch between the maculæ, but on the maculæ they are considerably larger. In some cases, the maculæ seem to be sub-solid in the center; others have a larger calyx occupying that position. A few interstitial tubes noticed, and a small number of "spiniform corallites."

On the under part of the base of the coral is a regularly outlined conical groove extending nearly across the middle of the longest diameter, to a pointed apex; the concave surface of the groove is covered with very delicate, crowded, transverse striæ (see figure 2a); this feature (the conical groove) is constant in all of seven examples examined. A delicate epitheca probably covered the entire base, but has, apparently, been weathered away. The conical groove seems to be altogether normal, and is a marked feature of the species.

A vertical section taken from one of the larger conical specimens, near the base margin, shows thin-walled corallites as taking a direct course from the base to the upper, outer surface. The tabulæ are clearly defined and closely set throughout. In some cases, the tubes show a series of vesicles attached to one side of the tube and extending only half-way across; direct tabulæ attached to the other side and occupying the other half. In a tangential section the tubes appear circular; and close to one side of each (inside) is a minute opening, then a dark, curved line from wall to wall enclosing the small opening, and shading off to the opposite side of the interior of the tube, giving the inner space a decided crescentic appearance. Prof. Nicholson, in referring to a similar feature of a different species, says it (the crescentic feature) "is due to the intersection of the peculiar vesicular tabulæ on one side of the tube."

The writer is indebted to Prof. J. C. Fales, of Center College, Danville, Kentucky, for the specimens used in this description. Prof. F. writes: "They seem to be quite numerous and in various localities below the Orthis lynx bed;" which indicates about the horizon of the tops of hills at Cincinnati, Ohio.

The name is given in honor of Prof. Fales.

GENUS STROMATOPORA, De Blainville.

Stromatopora tubularis, Sp. nov.

(Plate VII., figures 3–3b.)

This fossil is circular in outline transversely, and cylindrical longitudinally; composed of a succession of irregular laminæ about one-twentieth of an inch, each, in thickness, making up a total of from one-fourth to one-half an inch. Hollow inside (see figure 3). Cut transversely, the laminæ are shown as wavy, concentric lines of growth, with thin interspaces and serrate-like edges. Irregularly distributed throughout are small circular spots with dark centers and canal-like grooves, crossing the laminæ at different angles. Different specimens, used for this description, vary in *diameter* from two to two and one-half inches, and in *length* about one inch.

The tubular portions are all in part or wholly filled with other substances, broken corals and shells, or clay. The surface markings of all specimens so far examined are quite unsatisfactory, being overgrown, apparently, with some species of Polyzoan, and much weathered and abraded.

Magnified sections taken from the figured, type, specimen are shown in figure 3a transverse, and 3b longitudinal, across the vertical edges of the laminæ.

Found in the Cincinnati group at different localities and horizons at and near Cincinnati, Ohio.

STROMATOPORA LUDLOWENSIS, Sp. nov.

(Plate VII., figures 4 and 4*a*.)

This fossil is composed of irregular, undulating, concentric laminæ of variable thickness, from four to six in the space of one-tenth of an inch, including interspaces. Is of various amorphous outlines and sizes; sometimes built upon and around other substances. One specimen is 4½x3 inches in the longest and widest direction, and about two and one-half inches thick; grown upon Monticulipora mammulata (?), covering the coral nearly entire to the variable thickness of from one-tenth to over three-tenths of an inch. The specimen figured is not built upon any foreign substance, but is made up altogether of the concentric laminæ.

A polished transverse section (see figure 4*a*) shows the superimposed laminæ and a number of circular and oval pits, seemingly transversely cut-off oscula, irregularly distributed through the fossil; and a convex portion of the same specimen cut obliquely, at a low angle, through the laminæ, shows several of the canals traversing the mass in different directions. The surface of all specimens examined is irregular and rough, showing numerous minute pores and more or less of the larger—oscula—openings.

The type (figure 4) specimen and others used for this description, were found by the writer near Ludlow, Kentucky, opposite the lower part of Cincinnati, about fifty or sixty feet above low-water mark of the Ohio River. Cincinnati group. Others found on the hills of Cincinnati and elsewhere at higher horizons.

BLACK AND OSWEGO BASS.

BY CHAS. DURY.

Read and referred, August 5, 1884.

Dr. HENSHALL says in Appendix No. 1, of the eighth Annual Report of the Ohio Fish Commission: "Possibly no genus of fishes has been the occasion of so much confusion, scientifically and popularly speaking, as the Black Bass." Although Dr. Henshall is the highest authority on this subject, and gives very exactly the differences between the true "Black Bass," *Micropterus dolomieu*, and the "Oswego Bass," *Micropterus nigricans*, and although the extreme of *dolomieu* and the extreme of *nigricans* are very different, yet the intermediate forms are impossible to locate.

The differences given by Dr. H. are that the "Oswego Bass" has a much larger mouth than the true Black Bass. Hence he calls it the "Large Mouthed Bass," and the other the "Small Mouthed Bass." The

Large Mouth Bass has much larger scales than the other species, and the dorsal fin has the spinous rays lower and with a deeper notch than in the Small Mouthed species. Color is of no value whatever as a character, as the surroundings seem to determine this in a great measure, and both forms occur of all shades from black to white, but principally of different shades of green and olive.

The "Black Bass," in different sections of the country, has the following popular names:

Bass, Black Bass, Green Bass, Yellow Bass, River Bass, Bayou Bass, Slough Bass, Lake Bass, Moss Bass, Grass Bass, Marsh Bass, Oswego Bass, Perch, Black Perch, Yellow Perch, Trout Perch, Jumping Perch, Welshman, Trout, Black Trout, White Trout, Roanoke Chub, etc. The "Large Mouth Bass" seems to me grows larger than the "Small Mouthed" species. I have caught a Large Mouthed Bass in St. Mary's Reservoir, that weighed 7 lbs. and 14 oz.

I saw the head of one at Enterprise, Florida, that weighed 14 lbs. The largest specimen of the Small Mouthed form I ever saw, is the one exhibited, which was caught by a member of the Cuvier Club, and it weighed about 6 lbs., I think a trifle less. I have heard of specimens that weighed over 7 lbs., but never saw one. A fish nearly always weighs more on the scales of the person who catches it, than elsewhere. The greatest size attained by the Small Mouthed species has been a matter of much controversy. A very amusing incident occurred some time ago, when some wag sent a communication to a Pennsylvania paper, in which it was stated that the "Cuvier Club," of Cincinnati, Ohio, would give $100 in gold, reward for a "Black Bass" that weighed as much as 7 lbs. This was copied by papers all over the United States, and many disciples of Izaak Walton sailed in to capture a seven-pound Bass and the $100 reward. I was acting Corresponding Secretary of the Club at the time, and was tormented nearly to death answering communications. Some were of inquiry, and some claimed the reward and had numerous affidavits, duly sworn to before Magistrates, to substantiate their claims. One was a poor man and this $100 would do him a heap of good. Two others gave minute directions how to remit the money, on the strength of their sworn statement of a fish they once caught that would weigh over 7 lbs. I let them all down as easily as possible in my replies. I got partly paid for my trouble in eating the fine fish sent as proof positive to secure them this reward. The specimen stuffed is one of these. It was caught by Wm. Dormire and Chas Burrock. This is the letter that came with the fish.

WARSAW, IND., *March* 14, 1884.

OFFICERS AND MEMBERS OF CUVIER CLUB,
Cincinnati, Ohio.

Gentlemen:

We ship you per express this evening a Black Bass, caught by us with hook and line on Pike Lake, Kosciusko County, Indiana, one half mile from Warsaw, the county-seat, which weighs on three several scales 7¼ lbs.

We send the fish (packed in ice) to compete for premium of $100 offered by your Club for a Black Bass caught with hook and line, weighing 7 lbs.

Yours truly,
WILLIAM DORMIRE.
CHARLES BURROCK.

I replied to these gentlemen that the fish had been received, and I had stuffed its skin for the Club's Museum, and for so fine a specimen the Club sent thanks, and I had eaten the meat and felt better afterward, though I thought smaller fish were rather better than such large ones. I also stated that the Club had not offered a reward for the destruction of "Black Bass," and that the object of the Club was to increase rather than diminish the supply of food-fishes. Though I don't think it would be safe for me to go to Warsaw, Ind., yet I have not heard from the gentlemen since. I have often thought that the "Oswego Bass" was only a race produced by its surroundings. I never saw this form from the swift, flowing waters of our rivers, nor the Small Mouthed Bass from the still, dead water of the reservoirs. Some years ago, a pond in Avondale was stocked with some Small Mouthed Black Bass from Lake Erie. After a few years the owner of the pond moved away, and his successor did not care much about fish; so I went fishing in the pond, and all the fish caught were the Large Mouthed or Oswego Bass. Several years ago, Ross Lake, near Carthage, was stocked with genuine Small Mouthed Black Bass from Lake Erie, and now not a single specimen of the "Small Mouthed Bass" has been taken there, that I can hear of; all are the Large Mouthed or Oswego Bass. Mr. Wm. Hall, who is an excellent judge in such matters, and who has caught a number of specimens from Ross Lake, says they are all "Oswego Bass." I have heard of several isolated waters being stocked with "Black Bass," and after a few years, when the fish reproduced and were captured, all proved typical "Oswego Bass." This, though negative, is very strong evidence that the Oswego is merely a still-water race of the "Small Mouthed" species.

Dr. Henshall considers these Bass the most gamey fish living. Their voracity is astonishing. I have had the small three-inch specimens confined in my aquariums swallow minnows so long they were obliged to swim about for nearly an hour with the victim's tail protruding from their mouths, not being able to swallow the entire fish for want of capacity, and the head had to be digested before the tail portion could all be taken in.

Bass confined in a tank will never live peaceably together, but fight; or rather the larger ones drive the smaller ones, until they either kill them or make them jump out of the tank.

The spawn of Black Bass can not be hatched successfully by artificial means, as can the spawn of "White Fish" and "Pike Perch;" but to obtain young fish for restocking depleted waters, the fry must be obtained by netting them, a very difficult and laborious task. The small Bass furnished by the State Fish Commission to the Cuvier Club for distribution in the waters hereabout, cost the State $5.00 per one hundred fish.

ON CONODONTS AND FOSSIL ANNELID JAWS.

By U. P. James.

Read August 5, 1884.

Though of great interest to Paleontologists and Zoölogists, these minute fossil forms, of which we propose to give a brief account, had received but little attention, and very little was known in regard to them, ten years ago. The fact of their being so long overlooked by collectors of other fossils in the same strata where they are now found together, may be explained by their almost microscopic minuteness and invariably being detached, so far as now known, from their original position in the head of the animals to which they belonged. The published researches of Dr. Newberry and Dr. Hinde (referred to below) have stired up an interest in these fossil jaw plates and teeth that is not likely soon to flag, and is sure to lead to further important investigations and discoveries.

In 1856, Dr. Henrich Pander, of St. Petersburg, Russia, published the first account of Conodonts, which he considered to be the teeth of small sharks, which view has not been accepted, generally, by other Paleontologists.

Dr. J. S. Newberry ("Pal. of Ohio." Part II., p. 41–44, 1875) says, that Conodonts were found in great numbers in the Cleveland shale of the Waverly group—subcarboniferous—at Bedford, Cuyahoga Co., O., and that in regard to their Zoölogical relations it is yet quite impossible to speak with certainty. When first discovered Dr. N. submitted them to Prof. Agassiz, who pronounced them the teeth of Salachians. Prof. Owen (Pal., p. 116) says, that they have most analogy with the spines, kooklets or denticles of naked mollusks or Annelids. Prof. E. S. Morse—as possibly the teeth of naked mollusks, such as *Doris*, *Aeolis*, etc., and that they bear a strong resemblance to the teeth of mollusks, and might have be-

longed to the progenitors of our living forms. Prof. Stimpson—that they might very well be the lingual teeth of mollusks, but could not have formed the dentition or spinous armament of any Crustacean. Some Zoölogists have suggested that these singular bodies are the teeth of Cyclostomous fishes, and others that they are dermal Ossicles.

Dr. Newberry discusses quite fully the different views in regard to Conodonts, and comes to the conclusion that more proof is needed to establish their true position.

Mr. E. O. Ulrich (JOUR. OF THE CIN. SOC. NAT. HIS., Vol. I., July, 1878,) described and figured several forms that he considered "*Annelids*" under the new genus *Protoscolex*, U., but these were the *bodies*, not teeth or jaws.

The two species of so-called "Annelids" described and figured under the new genus *Walcottia*, Miller and Dyer—W. *rugosa* and W. *cookana*, M. and D. (JOUR. OF THE CIN. SOC. NAT. HIS., April and July, 1878). And W. *sulcata*, James (The Paleontologist, June 10, 1881,) are, probably, no more than the burrows of marine organisms.

Dr. George Jennings Hinde, F. G. S., probably the best authority on the subject of Conodonts and fossil Annelid jaws, published the results of his *extensive investigations* of the large collections made by himself. (*Quart. Jour. of the Geol. Soc. of London*, Vol. XXXV., p. 351, 1879). "*On Conodonts from the Chazy and Cincinnati Groups of the Cambro-Silurian and from the Devonian and Hamilton and Genesee-Shale divisions of the Devonian in Canada and the United States.*"

In this valuable paper Dr. Hinde alludes to the discovery of Conodonts by different persons at different times, and says that Conodonts were first noticed in America by Dr. J. S. Newberry (Pal. of Ohio, as quoted above).

"The appearance of the American Conodonts are so similar to those from Russia that Pander's descriptions will almost equally apply to both. They occur as very minute, shining bodies, sometimes consisting of a single, more or less conical tooth with an expanded base; but more frequently they possess an elongated basal portion, in which there is generally a large tooth with rows of similar or smaller denticals on one or both sides of the large tooth, according as this is central or at one end of the base. In some forms the large tooth is continued below the level of the base, forming one or more small, blunted extensions; and in one of the Devonian forms this extension is greatly prolonged and also supported denticles. In other examples there is no prominent central tooth; but the series of more or less similar teeth are carried on a straight or curved base."

* * * "The smooth and undisturbed outline of their bases plainly

indicates that they have not been broken from the edges of the carapace of any crustacean."

They are brittle and dissolve slowly in nitric acid. Mostly of a reddish horn color and translucent. Rarely white, though white is the usual tint of the Ohio Carboniferous specimens, and common in the Russian specimens. The Chazy specimens are of a black, glossy tint.

Prof. Huxley suggested the possibility that they might be the teeth of "Hag fish."

Dr. Hinde continues: "That, however, the *Conodonts* can not be referred to the horny jaws of *Annelids* may be conclusively shown by the discovery, by the writer, of these Annelidian structures in the same strata with Conodonts, from which the former can readily be distinguished by their chemical composition and their resemblance to the jaws of existing Annelids." Our present knowledge of facts is insufficient to decide the question as to the low type of fish teeth.

"Owing to the uncertainty respecting the animals to which the Conodonts belonged, any arrangement of the teeth themselves must almost entirely rest on an artificial basis, and, consequently, possess little Zoölogical value; detailed descriptions and figures, however, * * are of great importance and service for Paleontological reference."

Some of the difficulties in attempting to classify these minute fossil objects may be appreciated when it is understood in what an isolated, detached condition, from the bodies to which they belonged, they are found.

Different parts of the compound jaw apparatus scattered over and through the rocky strata, and never discovered in such a position as to establish the fact of their belonging to a single animal.

Dr. Hinde says in his paper "*On ANNELID JAWS from the Cambro-Silurian, Silurian and Devonian Formations in Canada and from the lower Carboniferous in Scotland*" (*Quart. Jour. of the Geol. Soc. Lond.*, Vol. XXXV., 1879,) that Dr. Ehlers published an account of fossil errant Annelids in 1867; and Prof. G. B. Grinnell, of Yale College, Conn., described (*Am. Jour. of Arts and Sciences*, September, 1877,) two specimens of Annelid jaws from the Cincinnati Group (Cincinnati, O.,) which he constituted the types of a new genus, *Nereidavus*.

Description of the Jaws. "The Annelid jaws occur as small, dark, shining objects, very varied in form, disposed through the rock, quite detached from each other, and from the positions they occupied in the head of the animal." Are of a bright, glossy black tint, but when much weathered the black is changed to a rusty, reddish tint. Composed of chitinous matter, and undergo no change in nitric acid.

" After careful comparison of these fossil jaws with recent examples of the order Annelida Polychæta or Nerida, I find specimens belonging to the families of *Eunicea*, Grube; *Lycoridea*, Grube; and *Glycerea*, Grube. * * * The only genus represented in the family Lycoridea, as fossil is *Nereidavus*, Grinnell."

Dr. Hinde published another valuable contribution on this subject the following year (*Quart. Jour. of the Geol. Soc. Lond.*, Vol. XXXVI., 1880), "On Annelid Jaws from the Wenlock and Ludlow Formations of the West of England," in which he says there is no striking difference in *form* of the English fossil jaws and American, but, as a rule, the American forms are the larger.

And another in 1882, "On Annelid Remains from the Silurian Strata of the Isle of Gotland, Communicated to the Royal Swedish Academy of Sciences," which was published in Stockholm, in pamphlet form, with three plates of 77 figures. This paper contains the result of collections made by Dr. H. himself in the Isle of Gotland. He found the Annelid remains similar to those already described from England and North America, many of them identically the same species; detached and scattered through the rocks in the same confused manner. He says: " Until some complete forms are discovered, showing the constituent plates of the jaw-armature in their relative positions, which, judging from my own experience, seems at present unlikely, we shall have to be content with a description of these detached jaw plates based upon their nearest resemblance to those of existing forms."

After listening to the reading of Dr. Hinde's papers (published in the 35th volume of the *Quart. Jour. Geol. Soc., Lond.*,) Dr. Woodward expressed his admiration of the labor and research displayed in these papers. He was satisfied that the conclusions as regards the Annelid jaws were correct; but that the Conodonts belonged to Myxinoid fishes he thought was more doubtful, and suggested that they might possibly be the lingual armatures of Nudibranchs. Though some of the Annelid jaws were not unlike the maxillipeds of Crustacea, the Conodonts had no such resemblance."

The weight of evidence seems to favor the view that *Conodonts* are the jaws and lingual teeth of Mollusks, and that the objects referred to *Annelids* belonged to very different organisms.

Some important facts and suggestions bearing upon this subject may be found in the August number, 1884, p. 776, of the *American Naturalist*.

" *On the Constitution of Some Appendages of the Mollusca*," by Prof. W. H. Dall.

Both Conodonts and Annelid jaws are found together, in the same

strata of the Cincinnati group, in the southwestern part of Ohio, but not, what may be considered, abundantly. The writer has noticed, also, in the same beds the "dark chitinous fragments" that Dr. Hinde refers to as, probably, the skin of the animals. A number of the specimens found in these beds I am able to identify as Dr. Hinde's species, by the aid of his clear descriptions and excellent figures, but others I have not yet succeeded in identifying. Four of these seem so decidedly different that I venture to describe and figure them as new species.

CONODONTS.

GENUS PRIONIODUS, Pander, 1856.

Prioniodus dychei, Sp. nov.

(Plate VII., figures A & B.)

The jaw of this species seems to be nearly entire, showing both the right and left sides, and prolonged anteriorally into a curved hook or tooth, standing at nearly a right angle with the jaw plate, and curved slightly inward. (See fig. A.) On the right side, viewed from the posterior end, there are six teeth, three of which are broken away just above the jaw plate, the stumps showing clearly, as seen in the figure (A). The other three project to nearly the height of the anterior curved hook, but are broken at the tops, as is the hook, as shown by the fractured apices. The portions broken away are evidently slight; this side of the jaw is linear; the teeth have a backward slope. In the other side of the jaw there are stumps of five teeth. It curves slightly outward from about the middle to the posterior end, and appears to have been broken off, as it is slightly shorter than the right side, and has one less dentation.

Length of jaw a little over $\frac{1}{16}$ of an inch; width, measuring from the crest of the long teeth to the base of the left side, is about $\frac{2}{3}$ of the length.

The teeth and upper portion of the anterior hook are of a light horn color, translucent and have a bright shiny luster; the jaw plate a lustrous black.

The type specimen (fig. A) used for this description was found in the upper part of the Cincinnati group, Warren Co., Ohio, by the Hon. Wm. W. Wilson, of Lebanon, that county. The other specimen (fig. B) was found by the writer near Eden Park reservoir, Cincinnati. The vertical range between the two localities, according to Prof. Orton's tables in Volume I., Ohio Geology, 1873, is over 500 feet.

By special request of Judge Wilson, the writer takes great pleasure in naming the species in honor of our highly esteemed friend Dr. D. T. D.

Dyche, of Lebanon, who has done so much in collecting and developing many of the finest Crinoids, etc., found in the Cincinnati group, and to whom we feel under great obligations for valuable information and other kind attentions.

GENUS POLYGNATHUS, Hinde, 1879.

Polygnathus wilsoni, Sp. nov.

(Plate VII., figure C.)

Jaw plate arched above and a little so at the base, with a slight projection or prominence near the middle; seven strong teeth in the upper arched portion of the jaw, the three central ones being entire, the other four (two on each side of the three) partly broken away, all standing at angles corresponding, mainly, with the curve of the arch. (See figure C.) The teeth are of a light, shiny horn color, translucent; the jaw below the base of the teeth black and glossy; the most prominent of the three perfect teeth, however, is of a dark color part of the way upward from the jaw. Length of jaw $\frac{1}{16}$ of an inch, height from base to top of longest tooth $\frac{2}{3}$ of length.

Another example has the lateral teeth, seemingly perfect, but owing to the rock, in which it is partly embedded, being of a similar light shade, it is different to determine this point positively; in other features and size it is nearly identical with the first.

The specific name is given in honor of Hon. Wm. W. Wilson, of Lebanon, Warren Co., O., who found the three specimens used for this description in the upper part of the Cincinnati group, at the same locality as the preceding described species.

ANNELIDA POLYCHÆTA.

GENUS ARABELLITES, Hinde, 1879.

Arabellites aciculatus, Sp. nov.

(Plate VII., figure E.)

The jaw plate has a comparatively long hook anteriorly, curving quite sharply inward. A regular curve from the point of the hook to the upper margin of the jaw and to the first dentation, forming almost a semi-circle, where the outline arches gently back to the posterior extremity. Seven short teeth, of irregular lengths, having a marked backward slope occupy this upper arched portion of the jaw. The curved outline from the top of the hook in front downward extends to a pointed shank below, about one-third the distance backward, where the lower margin curves upward, then backward to the posterior extremity. Quite a sharply defined ridge

extends from the point of the hook to the posterior end. Color of jaw a glossy, jet black. Size a little over $\frac{1}{16}$ of an inch in length, width less than the length.

This beautiful little fossil seems to be perfect, and is remarkable for the very delicate anterior hook, which is as sharply pointed as a fine needle, and stands out free from the rock to which the posterior end is slightly attached.

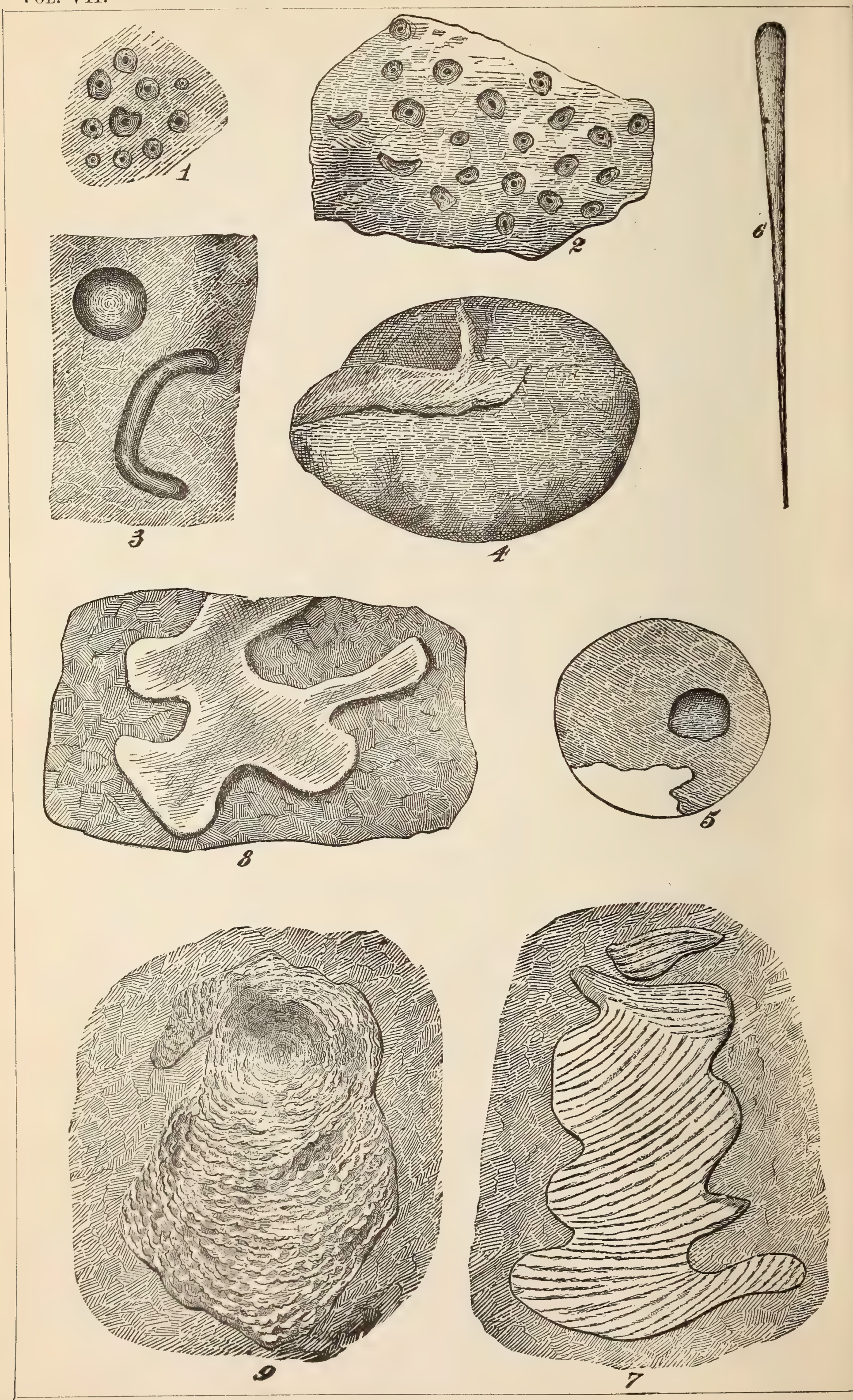
Position and locality. Bed of a "run" in Warren Co., O., near the Clermont Co. line, about four miles from Loveland. Cincinnati group. Found by the writer.

ARABELLITES HINDEI, Sp. nov.

(Plate VII., figure D.)

Jaw with a prominent, prolonged tooth in the anterior end, which stands at nearly right angles with the jaw, and is slightly curved inward at the point; just below the point is a regular curve forward and downward to the *base* of the jaw (as fig. D is placed). Back of the hooked-tooth are six small but conspicuous teeth, three of them standing erect, the other three slope backward the middle one (longest of the six) at a lower angle than the others; back of the sixth dentation, near the posterior end, is a slight elevation in the jaw which may be an immature tooth. In the posterior end of the jaw is an indentation extending to near the middle, causing an apparent pointed projection of the base. A longitudinal ridge, about the middle of the jaw, extends from the posterior end to the base of the anterior long tooth. Color of the jaw a shiny, jet black. Length $\frac{3}{32}$ of an inch, width $\frac{1}{3}$ of the length.

The very fine specimen used for this description is partly embedded in rock at the posterior end, but the other end stands out free. It was found by the writer in the bed of a "run" in Warren Co., O., about four miles from Loveland, Clermont Co., O., in the Cincinnati group.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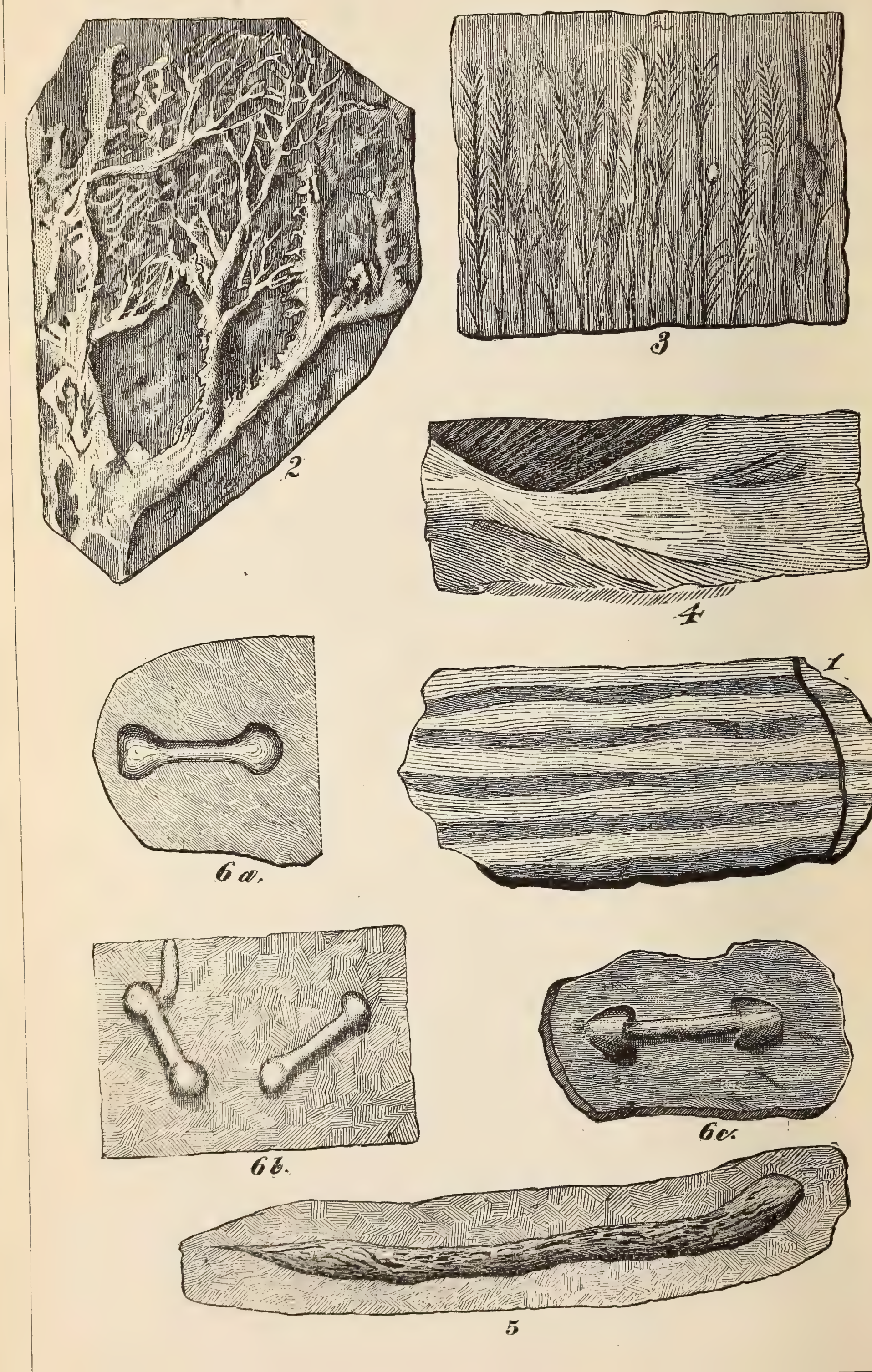
Description of Plate V.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6c.
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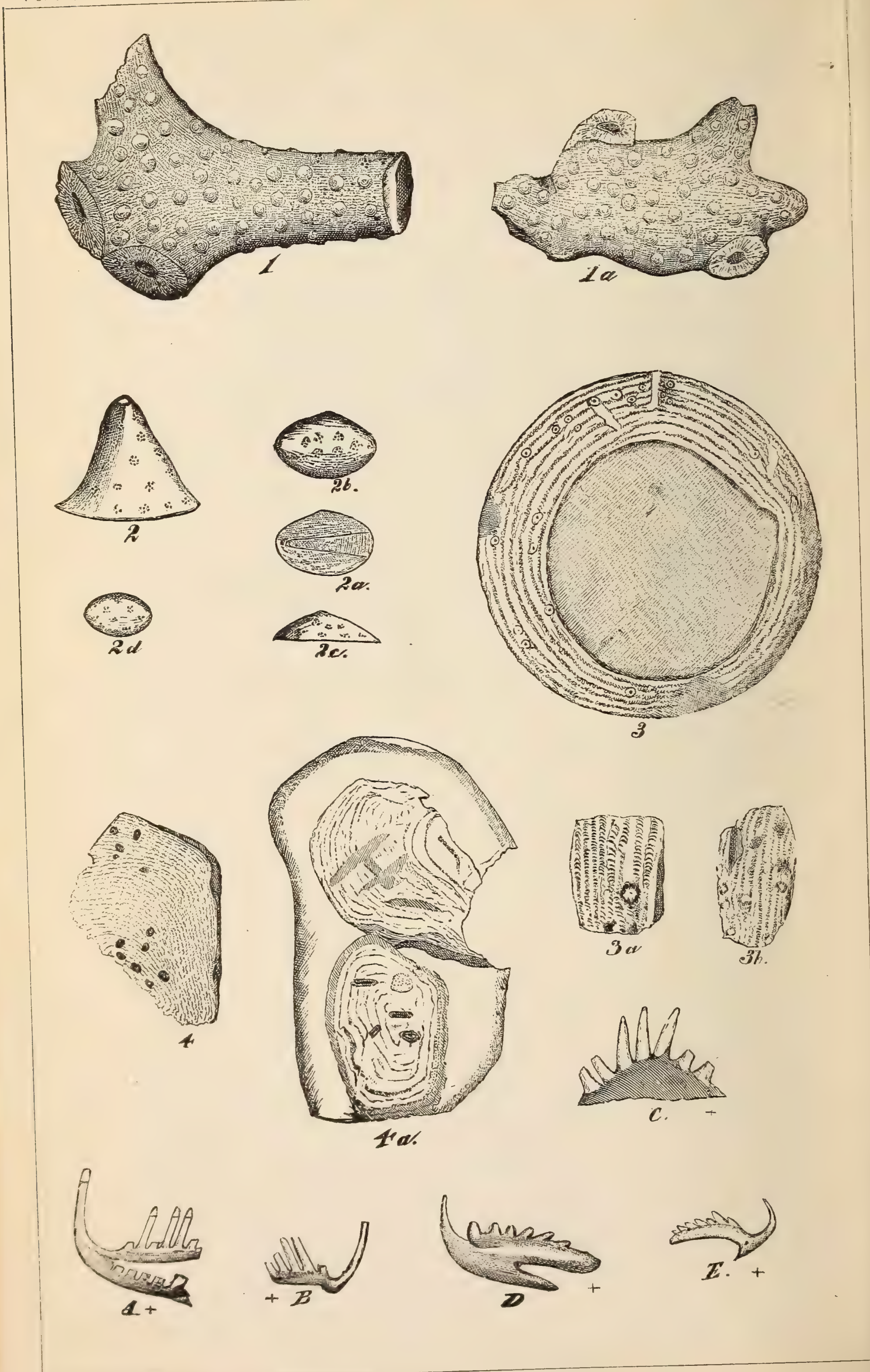
Description of Plate VI.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1a
2
2b.
2a.
2d
2c.
3
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3b.
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4a.
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A +
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E. +

Description of Plate VII.

Fig. 1. MONTICULIPORA OHIOENSIS, sp. nov., natural size.—A common form, large size, showing the general habit of branching and arrangement of the prominent monticules.

1*a*. Outline of an unusual form of the same species, natural size, . 137

Fig. 2. MONTICULIPORA FALESI, sp. nov., natural size.—One of the larger conical examples, showing the outline and stellate maculæ.

2*a*. Showing the under surface and conical groove. Same species.

2*b*. The upper surface of the same specimen.

2*c*. A lateral view of the same, all natural size.

2*d*. A younger specimen, as seen from above, natural size, ... 138

Fig. 3. STROMATOPORA TUBULARIS, sp. nov.—A transverse section showing the concentric laminæ and oscula?, natural size.

3*a*. A small portion of the same section, enlarged.

3*b*. Vertical section of same, enlarged, ... 139

Fig. 4. STROMATOPORA LUDLOWENSIS, sp. nov.—A transverse section showing the concentric laminæ and oscula?, natural size.

4*a*. A convex portion of the same specimen cut in another direction, natural size, ... 140

Figs. A & B. PRIONIODUS DYCHEI, sp. nov.—Greatly enlarged, ... 147

Fig. C. POLYGNATHUS WILSONI, sp. nov.—Greatly enlarged, ... 148

Fig. D. ARABELLITES HINDEI, sp. nov.—Greatly enlarged, ... 149

Fig. E. ARABELLITES ACICULATUS, sp. nov.—Greatly enlarged, . . . 148

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Publishing Committee.

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JOSEPH F. JAMES.

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CONTENTS.

Calendar for January to April, 1885:—

Tuesday, January 6.—Business and Scientific Meeting.
Tuesday, January 20.—Executive Board Meeting.
Tuesday, February 3.—Scientific Meeting.
Tuesday, February 17.—Executive Board Meeting.
Tuesday, March 3—Scientific Meeting.
Tuesday, March 17.—Executive Board Meeting.
Tuesday, April 7. Annual Meeting for Election of Officers.

The JOURNAL of the Cincinnati Society of Natural History is devoted to the proceedings of the Society. It contains such papers read before the Society as are deemed worthy of publication, and the general proceedings of the Society. It will be published quarterly, in April, July, October, and January. The subscription price is TWO DOLLARS per year, in advance. Single numbers Sixty Cents.

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No. 2 is entirely out of print, and the Society is desirous of obtaining copies of it, if possible.

Vols. IV., V., VI., and VII., 4 numbers, each volume, $2 00

The publishing Committee is not responsible for the opinions expressed by authors of papers.

THE JOURNAL

OF THE

Cincinnati Society of Natural History.

VOL. VII. CINCINNATI, JANUARY, 1885. No. 4.

PROCEEDINGS OF THE SOCIETY.

TUESDAY, *October* 7, 1884.

William Hubbell Fisher, President, *pro tem.*

Prof. A. D. Morrill, College Hill, Ohio, was proposed for membership.

A committee of three, composed of Prof. Jos. F. James, Edw. M. Cooper and Dr. Walter A. Dun, was appointed by the Chairman to arrange a course of free lectures during the winter.

The Librarian, A. E. Heighway, Jr., made some remarks relative to a recent visit to Washington.

The following papers were read and referred to the Publishing Committee:

FUCOIDS OF THE CINCINNATI GROUP.

BY PROF. JOSEPH F. JAMES,
Custodian of the Cincinnati Society of Natural History.

(Concluded from page 132.)

RECENT BURROWS AND TRAILS.

Next to mud markings on recent flats and river banks, those referable to trails and burrows come to be considered.

One of the first things to be noticed in studying these marks, is the wide difference in the appearance of those made on the very soft mud nearest the water, and those on that higher up and partially hard and dry. On the surface of the first the tracks have no shape at all; they form irregular depressions, which, higher up on the bank, appear definite. Here there is considerable room for errors in identification of certain marks, for those made by the same animal form would appear unlike in both places. It

would be only by observing the gradual passage of the one into the other that their true origin could be recognized.

Sir Charles Lyell, (Principles of Geology), has noticed in the Bay of Fundy the tracks made on the mud by various forms of animal life, and has stated that these marks are often well preserved by the deposition of mud by the tide. Many similar markings, made by different forms, have been noticed in studying mud banks, and reference will here be made to them in detail.

Trails made by mollusks of various sorts are most abundant. That made by a small lamellibranchiate shell (Cyclas) forms a series of semi-circles, as if the animal, in moving, had wriggled along in a one-sided manner and left its peculiar mark (Plate 8, figure 4). Still another, probably made by a Melania, is a broad, winding, sinuous trail, depressed in the center and elevated at the edges (Plate 8, figure 8). It is sometimes three feet in length, and twists and turns in all imaginable directions. Sometimes it ends abruptly, as if the animal had burrowed under ground and intended to appear in another spot.

Still another sort of trail, also probably made by a mollusk, turns and twists on itself and forms a series of interwoven loops or circles (Plate 8, figure 5). Still another sort forms a broad track, depressed in the center, elevated at the edges and marked outside by a continuous series of small depressions (Plate 8, figure 7). This is probably made by some sort of a many-legged creature, such as the hard-cased worms which live in rotten wood. Another trail is a long, sinuous line like the crenated edge of a leaf, and is probably also made by a mollusk (Plate 8, figure 6).

All these markings are very different from the true burrows, so common on all mud banks. Some of these are long and continuous, branching here and there, turning from side to side, or back on themselves, as it may happen. Those which have been noticed are made by beetles and a small larva, and differ considerably in appearance. They assume at the same time a different aspect, as they are covered or uncovered. In the first instance a regular series of transverse lines, formed by the small particles of mud thrown up in the course of the excavation by the insect, gives a reticulated appearance to the burrow, as shown in Plate 9, figure 1; but when this top is taken off, all the reticulations disappear, and there is left simply a hollow, having the same general form as at first, but being plain on the top and wider than before uncovered (Plate 9, figure 2). Unless it was understood that the difference in appearance was thus caused, it might be supposed that the two were the results of the work of different forms of life.

The burrows of the beetles are generally longer than those of the larvæ, and are made in a different way. Instead of the transverse lines noticed in the larvæ burrows, the mud seems to be thrown up in a series of pellets, arranged in lines sloping backward from the center, and thus giving quite a different appearance (Plate 8, figures 2a and 2b). Uncovered, as in the case of larvæ burrows, they also assume a very different aspect.

It has been noticed in a basin of muddy water that, on the settlement of the sediment to the bottom, it is often arranged in curious, irregular shapes by the small inhabitants of the water (Plate 9, figure 3). It would seem that these animals make their burrows by gathering the small particles of mud together and cementing them in some way that allows considerable stretching before breaking up. These burrows begin and end abruptly, and follow no regular pattern or design in the arrangement of the mud particles.

FOSSIL TRAILS AND BURROWS.

Having now noticed some of the markings on modern banks, it will be found that on ancient coast lines similar ones were made. Professor Hall, in the *Palæontology of New York* (Vol. II.), gives a number of plates showing the markings to be noticed on the rocks of Clinton and other formations. He recognizes that some of these are animal burrows and some trails; but he has, at the same time, erroneously identified as plants certain other markings which were found in rocks of lower formations. It is to errors like these—not alone of Professor Hall, but of others who have followed him—that attention will now be directed. It is likewise the intention to confine the present notice to such of these markings as are found or have been described as plants from the rocks of the Cincinnati group. It has already been intimated that there can be little objection to the naming and describing of burrows and trails, or Ichtholites, as long as they are regarded in their true light; but it certainly is neither logical nor scientific to speak of and refer to them as Algæ, when they have no connection whatever with the class. Taking the genera up separately, and examining each, will be the best way of showing the errors which have arisen from a misconception of the true character of these fossils.

Genus Rusophycus, Hall. 1842.

The genus *Rusophycus* was described by Professor James Hall in Vol. II. of the *Palæontology of New York*, page 23. He considered the fossils referred to the new genus to be plants or parts of plants. He gave as the generic character, "Plants consisting of simple or branched stems, which are transversely rugose or wrinkled." The genus was, at the same time,

made to include some remarkable ovate forms which have been the ones best known as species of the genus. These two species are *Rusophycus bilobatum* and *R. pudicum.* In the former the general outline is elliptical, with the surface sometimes nearly smooth, sometimes very rugose, and the specimens varying in size from an inch long and half an inch wide, to four inches long and three inches wide. A longitudinal groove runs the whole length of the fossil, dividing it into two distinct lobes. Occasionally an apparent stem is found attached to the central depressed groove, but generally this is absent. The distinguishing feature is the bilobate form.

In the latter species (*pudicum*) the specimens are also elliptical, are generally much smaller, smooth, and with the groove deep in the center, but disappearing before either end is reached.

Two other species of the genus were described by Professor Hall, viz., *R. clavatum* and *R. subangulatum.* These are quite different in appearance from those already noticed. Instead of being elliptical they are elongated, very many times longer than wide, with a depressed line along the center and obscure transverse ridges. In the JOURNAL of this Society (Vol. I., p. 25) Miller and Dyer described another species of the genus under the name of *R. asperum.* This differs from all those of Hall, in being quite rough, with "numerous papillæ," and lacking the transverse rugæ or wrinkles. In the Palæozoic Fossils of Canada (Vol. I.), Dr. Billings characterized a species under the name of *R. grenvilensis.*

After Hall had described and figured his species, it was found that D'Orbigny had, in 1842, described similar forms under the name of CRUZIANA. According to the rules of nomenclature this name must be used instead of *Rusophycus*, and to it all the species should be referred.

Under this last generic name Billings has described one species from Canada (Palæozoic Fossils, Vol. II.), viz., *C. similis.* This is similar to *bilobata* and *pudica*, in having the longitudinal line and the transverse rugæ, but differs in being longer and not elliptical. Dr. Charles White, in the Palæontology of Wheeler's Survey West of the Hundredth Meridian, describes and figures two other species of *Cruziana*, more like the ones of Hall. These two are *C. Linnarsoni* and *C. rustica*, and are from the Primordial Sandstone of Arizona. Both are elliptical in shape, and the first approaches *C. pudica*, while the last is close to *C. bilobata*, though the rugæ are more numerous and closer together. Neither of these show any traces of a stem.

Principal Dawson, of Montreal, in the *Canadian Naturalist*, proposed for these forms the name of RUSICHNITES, and in Acadian Geology, pp. 257 and 410, figured two species from the Carboniferous. One of them he

called *R. carbonarius.* It is quite small—about a quarter of an inch wide and but little longer, with the groove separating the lobes to a considerable extent. The other is *R. acadius.* This is longer, sinuous, with a deep line in the center and the elevated sides cut into small pieces by deep cross lines. The name of Principal Dawson can not be well used for such forms as Professor Hall has described, the name *Cruziana* of D'Orbigny being much the oldest of all. The last species, *R. acadius*, differs so much from the others that it can scarcely be included in the same genus.

Having noticed all the species of the genus known from America, a new species is here described.

CRUZIANA CARLEYI, N. Sp. (Plate 8, figure 1.)

Form elliptical, a little longer than broad; longitudinal furrow, extending almost from one end quite to the other, and there separating the lobes; center of the furrow broadened from a mere line out into an oval, about three quarters of an inch wide and one and one-half inches long; and then narrowing to the lower end, where it again flares out. Inside of this oval, on each side of a furrow in the center, are seven or more small ridges, separated by corresponding depressions. The upper end of the fossil is rounded; the lower is separated into two parts, each of which is rounded off in a regular manner; the tops of the lobes are nearly smooth, without any transverse rugæ.

This species differs from all the other described species, in being entire at one end and separated into two lobes at the other; and also, and especially, in having the seven or more pairs of elevations and depressions arranged in an oval in the center of the longitudinal groove.

The description is drawn from a specimen in the collection of the Cincinnati Society of Natural History. Mr. U. P. James has another and very similar one. His is wider and not so long in proportion, and the central oval is correspondingly broader and has ten instead of seven depressions. The specific name is given in honor of Mr. S. T. Carley, who presented the specimen to the Society a number of years ago. He collected it in the rocks of the Cincinnati group near Bantam, Clermont County, Ohio.

Character of CRUZIANA.

The fossils described under *Rusophycus* and *Cruziana* have been considered as belonging to the Algæ. Hall, Billings, White, Miller and others have so placed them. Dana, in his Manual of Geology (page 225), speaks of them as trails of articulates; and Dawson, in Acadian Geology, calls them impressions of trails of trilobites.

That they are not fucoids may be considered as settled definitely, and

that they are trails, or impressions of trails, of some sort of articulates, may be considered as probable. But what sort of articulates, is problematical. From the evidence now at hand, it seems likely that they are casts of trails of trilobites, or else casts of their bodies. Since the discovery of the locomotory appendages of the trilobite in the Oxford specimen,* a better idea can be formed of how the trail would look than it could before. Obscure specimens, undeterminable in themselves, become explainable when viewed through more perfect specimens. A fossil in the collection of this Society, long referred to the fucoids, is now recognized as a cast of the remains of the locomotory appendages of an *Asaphus*, such as was found at Oxford. Similar features in other specimens seem to show an approach to such remains. Some of these other specimens are very like species of *Cruziana*. Especially is it so with *C. Carleyi*, n. sp., though in this the heavy lobes on each side seem to militate against its having its origin there. Still, all analogies seem to point to some of the forms referred to *Cruziana* as the remains either of trilobites or else their trails. If the first, they still retain the shape, though they have lost all the outside shell.

Cruziana (*Rusophycus*) *subangulata* and *C.* (*R.*) *clavatum*, are two species described by Hall in *Palæontology of New York*, Vol. II. One is evidently synonymous with the other, the differences being merely in length. The first is longer and more regular than the last, but this constitutes the main difference. Neither one is a fucoid. Both are trails of Gasteropods, similar to those produced at present by Melania. The depressed line along the centre, with the corresponding elevated margins, are just what would be produced by the passage of the foot of a Gasteropod over soft mud. The first (*subangulata*), has not before been recorded from this vicinity, but last spring a rock was found at Ludlow, Kentucky, containing undoubted specimens of it.

Cruziana (*R.*) *aspera*, S.A.M., is neither a fucoid nor a track. It is a burrow, made by some one of the numerous annelids which lived on the Silurian sea-beaches, and which have left only their jaws in the rocks to tell the tale of their having lived. This species is rough on the upper surface with numerous papillæ, these having no doubt been caused by the mud or sand thrown up in the course of the making of the burrow. (Plate 8, figure 3). There is no sign of branching, but the burrows often cross each other at various angles. There is a slight depression down the centre, and the sides are elevated above the level of the rock, as would naturally be the case with a burrow made just beneath the surface.

*See this JOURNAL, Vol. VI., p. 200.

The other four species, viz., *C. similis*, and *C. Grenvilensis*, Billings, from Canada, and *C. Linnarsoni*, and *C. rustica*, White, from Arizona, are likewise trails of some sort, but not having been found in this vicinity, do not at present come under consideration.

Here now in this genus there are eight species which have been referred to the Algæ, and which can be disposed of as follows:

Cruziana (Rusophycus) pudica, Hall.		Crustacean Trail.
C	(R.) bilobata, Hall.	" "
C.........	(R.) grenvilensis, Billings	" "
C.........	similis, Billings.	" "
C.........	rustica, White.	" "
C.........	Linnarsoni, White.	" "
C.........	(R.) subangulata, Hall. (Syn. R. clavatum, Hall).	Gasteropod trail.
C............aspera, S. A. M.		Burrow.

Lastly, Cruziana Carleyi, n. sp., is propably the trail of an *Asaphus*.

Genus Saccophycus, James. 1879.

This genus was established by Mr. U. P. James, in the *Palæontologist*, p. 17, for a fossil with an "eneven, undulating surface, smooth or striated longitudinally," "the sides or ends rounded and drawn in and under." One species, *S. intortum*, was described. In the absence of figure or specimen, (only the type having been found), it is difficult to decide what this may have been. But from the description it is inferred that it is the burrow of an annelid instead of a fossil plant.

Genus Palæophycus, Hall. 1847.

The genus Palæophycus was characterized by Hall, in Vol. I., *Palæontology of New York*, p. 7, as having a terete, simple or branched, cylindric or sub-cylindric stem, the surface nearly smooth, without transverse ridges, and apparently hollow. A large number of species have been referred to the genus and considered as plants, but it is doubtful if a single one of them is a true Alga. From the rocks of this vicinity five species have been recognized, and these are arranged as follows:

Palæophycus flexuosus, James, has already been shown to be a ripple mark. (This Journal, Vol. VII., p. 129).

P. tubulare, Hall, is described as having a tapering cylindric stem, bent, flexuous and branched; the surface nearly smooth and the branches generally compressed.

P. rugosus, Hall, has a sub-cylindrical stem, with divergent cylindrical branches. The surface is very rugose, and the branches are flexuous.

There can scarcely be a doubt but that this species is the burrow of some sort of annelid. The rugose surface would be caused by the irregularly thrown up mud; the flexuous stem and the branching, by the windings of the worm. Burrows precisely like the specimens of this fossil have been noticed by the writer on muddy banks of the Little Miami River, and all facts point to the conclusion that instead of its representing the remains of an Alga, it is an ancient burrow.

The different appearance presented by the complete burrow and the same one with the top taken off, exposing the excavation, has been referred to, and in *P. tubularis* is to be found the *P. rugosus*, treated in this way. In other words, *P. rugosus* represents a complete burrow and *P. tubularis* one of the same sort, showing the hollow instead of the ridge.

P. simplex, Hall, with simple, cylindrical, flexuous stems, with the surface smooth or rough, can be referred to the same source as the preceding two species, and was likely made by the same animal form. Certainly the characters distinguishing the *tubularis* and the *simplex* are insufficient to separate them.

P. virgatus, Hall, described from the Hudson River group of New York, was found in the spring of 1884, by the writer, near Ludlow, Kentucky. The specimens were about an inch wide, and about eight inches long, of the same width their whole length, were slightly curved, and overlying one another in various directions. It is difficult to imagine what this fossil could have been, though it is not likely that it was a plant. It is more like the impression of a large Solen than anything else.

Genus TRICHOPHYCUS, M. and D. 1878.

This genus, established by Miller and Dyer, in JOURNAL OF CINCINNATI SOCIETY OF NATURAL HISTORY, Vol. I., p. 24, has included three species, of which *T. lanosum* was the type. Two of the species, *T. venosum* and *T. sulcatum*, have already been referred to under mud markings (this JOURNAL, Vol. VII., p. 131), and the third, or the type of the genus, no more a plant than the other two, is an evident burrow. The "plant" or fossil, according to the description, consists of a "round, flexuous stem, with a spheroidal swelling at one end," the surface being covered with "diagonal and longitudinal lines, as if made by the folding down of hair-like filaments." It seems most probable that these lines represent the arrangement of the mud particles thrown up during the making of the burrow. They are similar in appearance to the marks on *T. venosum*, but hardly referable, as that is, to rill marks, on account of the curving and twisting of the fossil. (Plate 9, figure 4).

Another genus, *Blastophycus*, was established by the same authors at the same time and in the same article as the preceding, and one species was described. It consists of a bud-like protuberance at the end of a stem or two stems, and bears so much resemblance to the enlarged end of *T. lanosum*, that there is little doubt about its being the same thing. The fact of its being so fragmentary and having so close a resemblance to *lanosum*, is sufficient reason for putting them together.

Genus Buthotrephis, Hall. 1847.

The genus *Buthotrephis* was characterized in 1847 by Professor James Hall, in *Palæontology of New York*, Vol. I., p. 8. It included certain fossils or "plants," with sub-cylindric or compressed, branching stems. Since the establishment of the genus, a number of species and varieties have been described, and five have been recorded as found in the Cincinnati group. Of these five, two are burrows of annelids, two are Graptolites, and the other is a water mark. None of the five are plants, and it is doubtful if *any* of the forms referred to the genus are Algæ.

Buthotrephis ramulosa, S. A. Miller, was described in the *Cincinnati Quarterly Journal of Science*, Vol. I., page 235, as a plant consisting of short-branched fragments, smooth or rugose, and scattered irregularly over and through nodules of indurated clay. From its general aspect it doubtless represents the burrows of some animal form. Parts of the burrows are on the surface, and parts below it, as if the worm had dived beneath the surface and come up again in another place.

B. succulosa, Hall, was described in the *Palæontology of New York*, Vol. I., p. 23, as having thick, succulent, branching and apparently hollow stems. It is evidently a burrow. It assumes various forms. Those described by Hall as *B. palmata*, and *B. impudica*, (*Ibid*, Vol. II., p. 20), are evidently the same as *B. succulosa*, though they come from a different horizon.

B. filciformis, James, described in the *Palæontologist*, p. 9, as a fossil with a slender, curved stem, with lateral branches set at an angle of 45 degrees to the stem, is referred, in the absence of figure or specimen, to the water mark called *Chloephycus*, as already adverted to. (This Journal, Vol. VII., p. 130).

The remaining two forms, *B. gracilis*, and its variety *crassa*, so long considered as plants, are not plants at all, but Graptolites, belonging to the genus *Dendrograptus*, Hall. A great deal of confusion exists in respect to this species and its varieties, and a full history of it will here be attempted.

In Vol. I. of *Palæontology of New York*, p. 62, was described a species under the name of *B. gracilis*, Hall. In the second volume (p. 18), a second species, the original having been called *Fucoides gracilis*, Emmons, was called *B. gracilis*, and the one in the first volume was renamed, and called *B. tenuis*. Under this second *gracilis* there were described at the same time two varieties, viz., *intermedia* and *crassa*. Finally, in Vol. II., p. 263, *B. flexuosa* was described. All these forms are closely allied, and though from different horizons, seem referable to the same species.

In the description of the *B. gracilis*, it is said that "scarcely any two specimens are alike, and it is difficult to fix upon characters which shall be decisive of specific importance." Professor Hall then goes on to show the gradation from the delicate filiform branches of the species, through ones with wider branches to the variety *intermedia*, and thence through other grades to variety *crassa*. The form he called *B. tenuis* is evidently intermediate between variety *intermedia* and variety *crassa*, and his *B. flexuosa* seems to be a distorted specimen of *crassa*. Taking this view of the species, they may be arranged as follows :

Buthotrephis gracilis, Hall.
var. intermedia, Hall.
var. tenuis, Hall.
var. crassa, Hall.
var. flexuosa, Hall.

Thus there are three species reduced to one with four varieties, which certainly cover the forms so far discovered.

Now if *Buthotrephis* is not a plant, what is it? To answer this question it will be necessary to go back a little.

Some years ago, Professor Leo Lesquereux, of Columbus, described from some specimens found in the rocks of the Cincinnati group of Lebanon, a species which he named *Psilophyton gracillimum*. He referred this to the Lycopodiaceæ, a family of land plants represented during the Carboniferous epoch by gigantic forms of vegetation. *Psilophyton* is a genus established by Dawson for certain plants with slender branches. The figure of *P. gracillimum* shows a small, thin stem, with branches at the top tapering to a point. (Plate 9, figure 5). It precisely resembles in its essential features the figure of *Buthotrephis gracilis*, given by Hall. (Plate 9, figure 6). It is considered by Walcott (*Tran. Albany Institute*, Vol. X., p. 21), as a species of *Dendrograptus*, (*D. gracillimum*), and other palæontologists have so regarded it. After describing two new species of the genus *Dendrograptus*, and referring to the undoubted connection of

Psilophyton gracillimum with this genus, Mr. Walcott goes on to say: "The resemblance of these two species [the two new ones], of *Dendrograptus* to Lycopodiaceous plants of the genus *Psilophyton* is very striking and apt to mislead the observer. Their occurrence with Algæ, graptolites, trilobites, and brachiopods in the same layers of shale, in a position indicating their position *in situ*, taken with their graptolitic structure, precludes the idea of their being of other than marine origin." The striking resemblance between specimens of *Psilophyton gracillimum* and *Buthotrephis gracilis*, leads to the inference that they are both the same, and as one has been referred to the Graptolites, the other should be also. Now, in relation to the varieties of *Dendrograptus* (*Buthotrephis*, *Psilophyton*) *gracillimum*, as it should be called, it might be supposed that specimens with wide and divergent branches would belong to other species. But it is well known that all the varieties run, as it were, into each other, so that no clear line can be drawn between them. Further, Lesquereux has described a species of *Psilophyton* under the name of *P. cornutum*, which is probably the same as Hall's variety, *intermedia*. It seems, therefore, in the opinion of the writer, as if all these species and varieties should be placed under one name, that of *Dendrograptus gracillimum*, the name *gracilis* being preoccupied.

Dendrograptus gracillimum, Hall.
(Buthotrephis gracilis, Hall).
(Psilophyton gracillimum, Lesq.).
var. intermedia, Hall.
(Psilophyton cornutum, Lesq.).
var. tenuis, Hall.
(Buthotrephis tenuis, Hall).
var. crassa, Hall.
var. flexuosa, Hall.
(Buthotrephis flexuosa, Hall).

Genus Lockeia, James. 1879.

The genus *Lockeia* was proposed in the *Palæontologist*, p. 17, by U. P. James for certain oblong bodies found lying on the surface of rocks from a certain horizon of the Cincinnati group. They were likened in form to grains of wheat, and were supposed to be parts of ancient Algæ. (Plate 9, figure 7.) From the study of these forms, and from the resemblance they bear to fossils found in other groups, it is likely that in this fossil, long referred to the Algæ, is to be found, what have been called by Hall, Nicholson, and others, the "ovarian capsules" of species of Graptolites;

and so far from their being the remains of plants, they are the reproductive bodies of Hydrozoa. According to Nicholson (Monograph of British Graptolitidæ, Part I., p. 70), the first information respecting these bodies was given by Professor Hall in 1848, when he described what he took to be "reproductive bodies" or "ovarian capsules" of *Diplograptus Whitfieldii.* In 1866, Dr. Nicholson announced the discovery of these "ovarian capsules" in the shales of Dumfriesshire, England. These are described (*Ibid*, p. 72), "when compressed laterally, as oval or bell-shaped bodies, provided at one extremity with a prominent spine or mucro; and the larger examples may be as much as from three-tenths to four-tenths of an inch in length, and from one-tenth to two-tenths of an inch in breadth." They exhibit little or no definite structure. When compressed from above, "they appear as rounded or oval patches, often very definite in their outlines, and exhibiting somewhere within their margin an elevated point, surrounded by several concentric, elliptical or circular rings, disposed with more or less regularity." The specimens of *Lockeia siliquaria* present no concentric or other lines. They are scattered promiscuously over the surface of the shaly rock, are from one-eighth to one-fourth of an inch long, and are from two to four lines wide at the base. Sometimes the ends are prolonged into points, sometimes they are obtuse; sometimes a longitudinal ridge runs along the top, and sometimes there is a slight depression in the center. They lie slightly attached to the rock, and can be easily separated from it. They show no signs of organic structure, and it is likely that this was all destroyed during the process of fossilization. Though unable to assert to what species of Hydrozoa these bodies belonged, it seems probable that they are really fossilized "ovarian capsules" of some of those species which are found so abundantly in the rocks of this group. It has been objected to this, that there have been found no Graptolites in the horizon where the *Lockeia* is abundant; but if the varieties of *Buthotrephis* are really Graptolites, as I believe them to be, then surely in these species the polyparys or stipes are large enough to bear bodies of the size of the *Lockeia.*

Impressions of Organisms.

While many of the "fucoids" have been described from fossil mud-marks, many from annelid burrows and gasteropod trails, a few from Graptolitic remains, still others have their origin in impressions left by organisms on the mud. These come under examination now, and an attempt will be made to clear up the obscurity resting on the nature of some of these forms.

Genus Dystactophycus, M. & D. 1878.

In *Contributions to Palæontology*, No. 2, pp. 2 and 3, Miller and Dyer established the genus *Dystactophycus* for the reception of certain fossils supposed to be plants, and consisting of rhizomes of fronds "mammiform or depressed conical," with the "surface marked by numerous closely-arranged concentric ridges or wrinkles." One species (*D. mammillanum*) was described and figured, and the generic description answered for the specific. It was supposed to be elevated above the surface of the rock one and a half inches; there was no appearance of any branch springing from the apex, and the whole "plant" consisted of this concentrically wrinkled frond, elevated in the center.

From the rocks of the Niagara group, Professor Hall has described a coral which has long been known as *Lichenalia concentrica.* It can now be conclusively shown that certain species of *Monticulipora* have bases which are marked with concentric lines very similar to those of *Lichenalia concentrica*, and there can hardly be a doubt but that they are the same. A figure of Hall's species is given in the *Palæontology of New York*, Vol. II., Plate 40E, which exactly resembles the markings of the *Dystactophycus.* This "fucoid," then, has resulted from the impression of the base of a coral resting on a mud-bank and leaving its mark in the concentric rings The elevated portion is the part extending up into the base of the coral stem, and the outer rings mark the extent of the expanded base. Comparison of Hall's figure and specimens of *Dystactophycus* leave little doubt as to this fact.

Another and yet more striking impression has also been described as a fucoid under the

Genus Heliophycus, M. & D. 1878.

This is in *Contributions to Palæontology*, No. 2, and *H. stelliforme* is the only species. It has a "star-like frond, without any stem or evidence of attachment," with five rays, each one apparently round and tapering to a point. "They were evidently flexuous," and had rugose markings on the surface—the lines near the body "forming an angle in the middle, and bending forward down the side; farther from the body the lines become arcuate on top, while toward the points of the shoots [rays] the lines are somewhat irregularly transverse." It seems quite evident that this, instead of being the remains of an organism, is simply the impression made by one of the numerous species of star-fishes (*Palæaster*, etc.) which have been found in this group. The lines are probably caused by the arrangement of the plates on the under side of the body; but the surface of the mud not tak-

ing the impression perfectly, the marks of the plates have not been preserved.

Genus Licrophycus, Billings. 1865.

This genus was established by Billings in *Palæozoic Fossils of Canada*, Vol. I., p. 99. The species described had broad, flat branches springing from an apparent stem. The one from this group, however, *L. flabellum*, M. & D. (*Contributions to Palæontology*, loc. cit.), is the only one here considered. The authors do not distinctly call the fossil a plant, but state that the species consisted of numerous slender branches, "springing from a common root or stem." All the branches are transversely wrinkled; sometimes lying in a close bundle, and sometimes spread out in the shape of a fan. The figure given is a fragment of a poor specimen. Better specimens indicate that the branches were flexible and curved. From the best impression seen by the writer (Plate 9, figure 8), he is reminded of the appearance that would be made in mud by the expanded tentacles of a crinoid. The transverse wrinkles have every appearance of it. It is his opinion, however, that the form under study is really the impression of the remains of a species of Graptolite, probably of the genus *Inocaulis*, Hall. It is very different from the *I. plumosus*, Hall, but very similar to a figure given of *I. Walkeri*, Spencer, in *Bulletin of the State University of Missouri*, No. 1, by J. W. Spencer, and found in Canada. The name *Inocaulis flabellum* is suggested for our species, instead of *Licrophycus flabellum.* It is quite evident that it is not a plant, and the probabilities are that it is Hydrozoic in its origin.

Genus Dactylophycus, M. & D. 1878.

This genus, with two species, was described in *Contributions to Palæontology* (loc. cit.) They were called *D. tridigitatum* and *D. quadripartitum.* They are, in the first place, so similar, as to warrant their being placed together under the same name. They were, too, described from mere fragments, and there is no saying how much or how little of the fossil the figures represent. Certainly they are not worthy of a distinct genus; they are not plants; they are similar to a form, figured by Hall, as an undetermined species of *Palæophycus;* and they were named by Orton, in "Geology of Ohio," Vol. I., p. 387, in 1873, *Palæophycus radiata.* They probably represent portions of burrows, if, indeed, they are not wholly inorganic in their origin.

Review.

Reviewing now all these supposed Algæ, there is not a single one which seems entitled to remain in the class. They are referred to three different sources:

First, inorganic causes, including *Aristophycus ramosum* and *var. germanum; Chloephycus plumosum*, and, as a synonym, *Buthotrephis filciformis; Trichophycus venosum, T. sulcatum; Arthraria antiquata*, including *A. biclavata; Discophycus typicalis; Cyathophycus subsphericus; Dystactophycus mammillanum; Heliophycus stelliforme.*

Second, to trails and burrows, as follows: *Trichophycus lanosum*, including, as a synonym, *Blastophycus diademata; Palæophycus radiata*, including *Dactylophycus tridigitatum* and D. *quadripartitum; Palæophycus virgatus; P. rugosum; P. tubulare; Buthotrephis succulosa; B. ramulosa; Saccophycus intortum; Cruziana subangulata*, including species as before mentioned (see *ante*, p. 156); *C. aspera; C. pudica; C. bilobata; C. carleyi.*

Third, and last, to the Hydrozoa, viz.: *Dendrograptus gracillimum*, to include *Buthotrephis gracilis* and its varieties (see *ante*, p. 160) and *Psilophygracillimum; Lockeia siliquaria; Inocaulis* (*Licrophycus*) *flabellum.*

Conclusion.

In this paper there has been no attempt to rename any of those species which have attached to them the suffix "*phycus*," to indicate their plant-like nature. It seems a mere piling up of unwarrantable names and a complication of the synonymy to do so. Those whose nature has been shown to be inorganic, should be allowed to sink into oblivion. Those representing trails or burrows are, perhaps, convenient as a matter of reference, but they should no longer be attached to the Algæ; while those here referred to the Hydrozoa should take their places in the class to which *ton* they belong.

Since these investigations were undertaken, and after the major part of this paper was written, I find that Mr. S. A. Miller, in the "Supplement to his Catalogue of Palæozoic Fossils," acknowledges that *Aristophycus* and *Chloephycus* are "probably inorganic." All the others remain in their original places in the class Algæ. I am also informed by Professor Lesquereux, that several years ago the late Mr. Dyer sent him a large box of these fossils, with the request that he describe them. This he declined to do, returning them with the remark that they were too fragmentary and too ill-defined to be of scientific value. Afterward many of these were described as fucoids by Miller and Dyer in the *Contributions to Palæontology*, so often referred to in this paper.

Professor Lesquereux has been kind enough to forward to me a French translation of a memoir written in Swedish by Professor Nathorst. In this memoir are given the results made by Professor Nathorst in endeavoring to produce, artificially, marks found fossil. He succeeded admirably,

and found that many of the fossils previously referred to the Algæ were inorganic in their origin, and that many more were casts and impressions of trails and burrows. It is but fair to state, however, that Saporta, of France, does not agree with Nathorst. The observations in the present paper accord with those of the Swedish naturalist.

After speaking of the character of certain other fossil marks, and referring them to the tracks of worms of different sorts, Nathorst says of the species of the *Contributions to Palæontology*, of Miller and Dyer:

"In the same way all the Algæ of the 'Cincinnati group,' described by Miller in 1874, and with Dyer in 1878, must be either traces of animals or objects of purely mechanical origin. Thus, the *Buthotrephis ramulosus* (Miller, 1874) is of the same species as the greater part of the Chondrites; the *Blastophycus* and the *Trichophycus* are of purely inorganic origin (drops or courses of water?); the *Rusophycus asper* is a track similar to that of the *Synapta* or of the *Nychia*, while the *Licrophycus flabellum* must be the track of a worm, or, perhaps, of an Ophiuridian. The *Dactylophycus* is, perhaps, the molding of worm-holes; the *Heliophycus* might be the impression of a medusa; the *Dystactophycus* is undoubtedly of inorganic origin; the *Chloephycus*, of which I saw a specimen in Sweden, is most assuredly a result of running water (all the stems are turned to the same side); and, finally, the *Aristophycus* can hardly be anything but ridges on the surface of the rock. No one of them has any resemblance to the Algæ; but the American palæontologists, as shown above, have long had the habit of describing all doubtful objects as belonging to this vegetable group, whatever may be otherwise their aspect and their structure."

The above quotation is given as corroborative evidence of the position taken in the present paper. It is desired to have it distinctly understood that my own ideas and theories were developed entirely independently of those of Nathorst, whose memoir I never saw until this paper was nearly ready for publication.

ON COLOR.

BY COL. JAMES W. ABERT.

THIS is a subject of great importance to the student of natural history. In many of the objects which come under his scrutiny, colors constitute an important characteristic. Many of these objects lose their tints and undergo subtile changes of color. We find birds, fishes, shells, insects, plants, and even minerals, characterized and exalted to objects of marvelous beauty by the quality of color.

Light and color possess very important relations to organization and life. But I propose to confine my remarks to the systematizing of an arrangement of colors, which I have found of great practical value, in assisting the student in his attempts to give the proper colors to objects of natural history.

The first three elementary colors, namely: the yellow, the red, and the blue, are called primary colors, and these terms—primary, secondary, and tertiary—not only indicate the order in which the colors stand, but also the character of the combination; for primary designates a simple, elementary color; secondary, a combination of two primaries; and tertiary, a combination of the three primaries—in which one of the said primaries is dominant.

But there is an inherent defect in the nature of our pigments—none are perfect of their kind; the yellows contain some red or blue, the reds contain some yellow or blue, and the blues contain some yellow or red; therefore, in mixing, to get brilliant secondary tints, we must so select the two primaries that the third one does not enter; for this would give us a tertiary, which is more or less dull, in proportion to the intensity of the third color thus added. The great difficulty against which we have to contend, is the vague and indefinite ideas that people have of the primary colors. Very few persons have any idea of what the standard, or typical, colors should be. Take, for instance, red; they call numerous colors red—never mind how different the hues may be; never mind what may be their intensity, whether dark or pale, bright or dull, in light or shadow.

The culture of the eye for color has been grossly neglected. You may take pictures by the most famous colorists of the Venetian school—Vivarini, Carpaccio, Tintoretti, Bellini or Titian—in which the masses of color are appropriately balanced, are perfectly harmonized; diminish or increase the superficial extent of these masses, how few eyes will appreciate any difference. In music, the ear is much better educated; and the slightest sharpening or flattening of a single note which enters into an harmonious

arrangement of chords, or a false note in a melody, is instantly perceived and instantly resented. We must fix our standard of colors by careful study of the spectrum.

If the colors, as obtained from the analysis of the solar spectrum, be arranged on a circular disk, and the proper superficial extent of surface be given to each color, by rapidly whirling the disk, the colors recombine and will produce white; each set of any two primaries will have the proper secondary between them, and the colors pass round and round the circle, conforming to the law for mixing colors. The colors will be found to conform in relative position to the following figure:

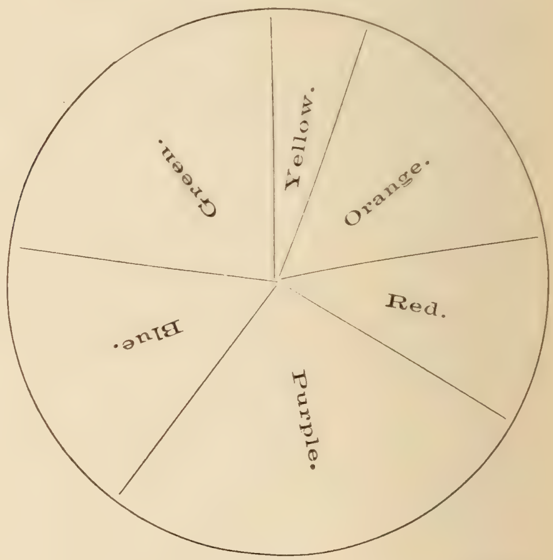
Diagram of the relative superficial areas and angular spaces to be given to each color, in order to form an harmonious combination.

YELLOW=1, or 20°;
RED =2, or 40°;
BLUE =3, or 60°;

120°.

ORANGE=3. or 60°;
GREEN =4, or 80°;
PURPLE=5, or 100°;

240°.



J. W. A.

I will now give you some diagrams which, in a condensed manner, will display the classification and combination of the colors, which may be analyzed into an infinite number. Yellow is akin to light, and blue to darkness, while red is the transition color. If you add yellow to any color, it renders it paler; and blue darkens the tint.

In the following diagrams, you will find the lighter colors in the uppermost line, the transition colors in the middle line, and the darkest in the lowest line. The Roman numerals designate the order of position :

Primaries.	*Secondaries.*	*Tertiaries.*
I. Yellow, .	IV. Orange, . .	VII. Citrine, .
II. Red, . .	V. Green, .	VIII. Russet, .
III. Blue, . .	VI. Purple, . .	IX. Olive, .

The arrows indicate the manner in which the colors are combined; *i. e.*, how the secondaries are derived from the primaries, and the tertiaries from the secondaries.*

The following diagram shows the relative amount of superficial space each color should possess, in order to form an harmonious combination:

I. Yellow, . .	1	IV. Orange, .	3	VII. Citrine, .	7
II. Red, . .	2	V. Green, . .	4	VIII. Russet, .	8
III. Blue, . .	3	VI. Purple, .	5	IX. Olive, . .	9

The numerical values attributed to the spaces occupied by the colors, as derived from the solar spectrum, are given of different values by writers on optics; but for practical purposes, the numbers one, two and three give relations that are satisfactory for all our purposes, and readily remembered.

Now, combining these colors by algebraic symbols, we get the following diagram:

I. Yellow,	IV. Y.+R.=Orange,	VII. 2 Y.+B.+R=Citrine.
II. Red, .	V. Y.+B.=Green,	VIII. 2 R.+Y.+B=Russet.
III. Blue, .	VI. R.+B.=Purple,	IX. 2 B.+Y.+R=Olive.

A simple idea of the tertiaries can be obtained by considering them all as grays; for the citrine is a yellowish gray, russet is a reddish gray, and olive is a blueish gray. A pure gray is a true neutral tint, made up of all three of the primitive colors, in such proportions that no one of them is perceived to preponderate.

* Any vertical row of colors is deduced from the row on the left, by combining:
The first and second to form the first.
The first and third to form the second.
The second and third to form the third.
Thus to form the secondaries:
We combine yellow and red to form orange.
" " blue " green.
" red and blue to form purple.
And when we wish to form the tertiaries:
We combine orange and green to form citrine.
" " purple to form russet.
" green and purple to form olive.
In my diagrams and formulæ I had arrows drawn, which by the course they pointed out, designated the manner of mixing the colors; but, as it would be difficult to represent the arrows in type, I hope the above explanations will prove to be sufficiently clear to be understood.

In the masterpieces of olden times, great attention was paid to the harmony of colors; each color possessed a certain intensity, and a certain relative superficial area in every picture. I possess a life-size copy of one of the great Spanish painter's (Murillo) Madonnas. Pale orange, or flesh color, occupies one-tenth of the picture; red, one-tenth; blue, of deep, rich tone, two-tenths; and gray, which surrounds the colors, occupies six-tenths, of the canvas. The main mass of red is placed near the faces of the mother and child, to concentrate attention there.

The Six Colors of the Solar Spectrum.

There are three primary, and three secondary colors. The primaries have never yet been decomposed, hence, are considered elementary colors.

White is produced by all the colors of the prism being recombined.

Black is the absence of all color.

Hues are made paler by mixing them with white.

Darkening hues, by mixing them with black, produces tones of color, and impairs their brilliancy. It should not be done. To darken any hue use darker hues of the same color, then your coloring will be brilliant.

Some colors are of mineral and some of vegetable materials; therefore, the mixing of them may produce abnormal results.

The standard type of any color is to be found near the middle space of that color in the solar spectrum.

The degree of strength of any color is an important point to be fixed.

Some colors in painting are more self-asserting than others; *e. g.*, a very small quantity of indigo has a powerful influence upon other colors.

In mixing any two pigments of the primary colors, those combine best which possess already some of the hue they are mixed with, and hence have an affinity for each other; *e. g.*, the most beautiful purple is formed by mixing indigo and lake, as indigo contains some of the hue of lake, and lake contains some of the hue of indigo.

The high lights on smooth, polished or shining objects, are pure white in outdoor daylight. They reflect the highest light of the luminary.

Guided by this principle, the juxtaposition of colors in paintings, in dress, in furniture, in planning gardens, in bouquets—indeed, wherever colors are employed—ceases to be a matter of accident, or an ill-understood experience, and becomes a subject for rules and the predictions of science.

In all chromatic combinations, harmonies of contrast must first be sought. But as these are limited, harmonies of analogy are also called into requisition, with less striking, but often with pleasing, results.

These may be secured in three ways:

(*a*). By arranging different tones in a series.

(*b*). By associating nearly related hues of a like tone.

(*c*) By viewing appropriate groupings of color by a colored light, as that from a stained window, which modifies them all in a particular direction.

COMPLEMENTARY COLORS.

Yellow has purple. Red has green. Blue has orange.

An important rule in mixing colors or pigments, is:

If the relative quantity of each color existing in the normal solar spectrum be not maintained, an uncompensated portion of one or more colors must remain, and the result may appear to be abnormal.

M. Chevreul, Superintendent of the Dyeing Department of the Gobelin Manufactory at Paris, has published one of the best books extant, on the subject of colors.

Chevreul's law for both hues and tones, is:

"When the eye sees at the same time two different contiguous colors, they will appear as dissimilar as possible, both in optical composition and in height of tone."

WHITE.—The effect of the contiguity of white is to deepen all hues, unless it be of a light yellow. With deep hues and tones the contrast of white is generally too violent.

BLACK.—Black accords well with any hue or tone except the deeper, as indigo or violet, which it renders apparently gray and faded.

Heavy gilded frames near too strong red or orange, is a violation of chromatic harmony.

Black and dark colors diminish, white and light tones enlarge an object.

All colors in the vicinity of the face influence the complexion.

Hues and tones of green improve a pale or blonde complexion.

Orange whitens the brunette complexion.

Light or pale tinted colors agree best with light, and deep or shaded colors with dark complexions.

Carpets, paper hangings, curtains, and furniture for rooms, should be of colors chosen with reference to their effects upon each other, and upon the complexions of the inmates.

The beauty of red flowers is enhanced by the neighborhood of green foliage.

When we look continuously on any color, as red, the color loses its vividness and beauty, because a color the opposite of red is excited in the eye and blends with it; but its complementary or any color near to this, as green, being now presented, the latter is at once improved, rendered

more pure and vivid by the acquired tendency of the eye to see that color. This is successive contrast; and it is shown that colors which will harmonize or affect the eye agreeably, or be improved by being viewed in succession, are opposites or complements, of each other. Colors nearly allied will be injured when thus beheld, and will affect the eye unfavorably.

We now see the great importance of color, and the absolute necessity of surrounding ourselves with properly arranged combinations of the various hues of the solar spectrum.

The effects of the influence of colors upon animals, is a subject well worthy of investigation by the student of natural history and by the medical profession. Walter Smith, the State Director of Art Education in Massachusetts, narrates the following incident:

"I was once informed of the utter misery inflicted unintentionally upon a man, whose life was as valuable to society as to himself, by the presence, in a sick-room, of a wall-paper which had certain prominent red spots upon it, appearing at intervals in the pattern. He was just past the climax of a typhoid fever, and had just arrived at that stage when the mind, not yet in full possession of the exhausted body, conjures up delusions—an almost inseparable stage in recovery from such a malady; and so critical a time that any relapse, through excitement or other causes, is almost certain to end fatally. Before the mind was capable of consecutive thought, like that of the child just strong enough to receive impressions only, the patient opened his eyes, to perceive on all sides a fiery red eye gazing on him from the walls of the room. That took the form of a delusion; and his semi-delirious efforts to hide these dreadful eyes from his sight, almost brought on a fatal relapse. Curtains were hung closely round him, though neither the nurses nor doctor were suspicious of the cause of his delusion. His convalescence was then rapid; he became sufficiently conscious to speak collectedly, the curtains were removed, and then the red balls tortured him in another form. Do what he would, he could not help counting them from floor to ceiling, from one wall to another; counting the figures mentally, adding and subtracting, without power to control himself, until he was almost in a worse fever than ever; at last he was sensible enough to beg to be taken to a room where there was no paper at all, and then found repose and comfort. The tortures he felt during that time were indescribable; and his grief was, that he had not strength enough nor clearness of head enough to explain what it was that afflicted him." In the same work he says: "A man could no more live in a room painted a glowing red color, than he could live in fire or stare at the noonday sun."

We are most of us familiar with the excited feeling provoked among turkeys on seeing a red dress; also on cattle and cows. Fish and frogs are caught with red rags or red feathers. The timid antelope of the prairies is lured within rifle-shot by a red handkerchief displayed from the end of the hunter's ram-rod. The wild bulls of the Spanish arena are provoked into fury by the displaying of the banners of the matadores. If, then, these animals are thus influenced so powerfully, how much more effect for good or evil must be produced on the human race, which possesses such a complex and delicate organization of mental and nervous structure.

A number of color sketches were exhibited by the speaker, and examined with interest by the members present.

THE donations for the month were announced as follows: From Geo. W. Campbell, Delaware, O., "Seventeenth Annual Report of the Ohio Horticultural Society;" from U. S. National Museum, "Proceedings of the U. S. National Museum," Vol. VII., Nos. 10 to 21; from D. L. James, "Smithsonian Report for 1861; Report of U. S. Coast Survey 1859–1860;" from N. H. Winchell, First, Tenth and Eleventh "Annual Reports of the Minnesota Geological and Natural History Survey;" from A. P. Butler, Columbia, S. C., "Resources, Population, Institutions and Industries of South Carolina;" from Natural History Society, Newport, R. I., "Proceedings for 1883–1884;" from U. S. Fish Commission, "Bulletin," Vol. IV., Nos. 17 to 22; from U. S. Geological Survey, Williams' "Mineral Resources of the United States;" from Chief Signal Officer, "Monthly Weather Review," July, 1884; from Zoological Garden, Specimens of *Lynx Canadensis*, *Erithizon dorsatus*, *Ibis rubra*, *Grus Americanus*, *Equus Burchellii*, *Cebus hypoleucus*, *Meles taxus* (male and female); from John Donahue, War Relics from the Battle-field of Seven Pines; from Bureau of Education, "Circulars of Information," Nos. 4 and 5, for 1884; from Ottawa Field Naturalists' Club, "Transactions," No. 5; from E. F. Bliss, Specimens of Minerals and Fossils; from Col. Jas. W. Abert, Ores from Colorado and New Mexico; from Mrs. Eli Kinney, Specimens of Minerals and Indian Relics—skull of Black Skimmer, etc.; from Robert Clarke, Mummy from Egypt; from Miss E. W. James, Young Horned Owl; from Wm. Nevins, Specimen of Banded Sandstone; from Chas. Dury, Hornet's Nest and Lamprey Eel; from A. E. Heighway, M. D., Conglomerate and Coal from Pennsylvania, and pamphlet on Anthracite Coal-fields.

MEETING OF NOVEMBER 4.

Vice-President Harper in the Chair.

The following paper was read and referred to the Publishing Committee:

ON PALM TREES.

By Jas. W. Abert.

While reading recently about the palm trees of South America, I met with the following statements:*

"In Chili, every year in early spring (which occurs in August) very many palm trees are cut down, and when the trunk is lying on the ground, the crown of leaves is cut off.

"The sap then immediately begins to flow from the upper end, and continues so doing for many months; it is necessary, however, that a thin slice should be shaved off from that end every morning, so as to expose a fresh surface.

"A good tree will give ninety gallons, and all this must have been contained in the vessels of the apparently dry trunk.

"It is said that the sap flows much more quickly on those days when the sun is powerful; and, likewise, that it is absolutely necessary to take care in cutting down the tree that it should fall with the head upward on the side of the hill; for if it falls down the slope (*i. e.*, with the butt end higher than the crown), scarcely any sap will flow, although in that position one would have thought that the action would have been aided, instead of checked, by the force of gravity. The sap is concentrated by boiling, and is then called treacle, which it very much resembles."

It has often occurred to me that the experiment might be tried with our sugar maples, in regard to the more bountiful flow of sap, when the position of the tree most conforms to its growing position in nature.

It seems strange that a tree, after its connection is severed with its roots, should still be capable of yielding ninety gallons of sap. If the tree in itself contained ninety gallons of sap, I should think that that amount could be obtained, whether the crown or the butt end lay uppermost. It would seem that the tree still continued to manufacture sap.

Palms are particularly interesting as conspicuous types of monocotyledonous and endogenous plants. They are trimerous; the dominant number which characterizes them is three, or multiples of three. Their leaves are pinnate, as in the cocoanut tree; or flabelliform, as in the palm-leaf

* Charles Darwin's "Naturalist's Voyage Round the World."

fan. I am familiar with three noted forms, which characterize their stems: The tree form, as in the palmetto of Florida; the vine form, as in the rattan; and the melon or pineapple form, as in the cycas.

There are one thousand species, and they are found in tropical and semi-tropical regions, where they are of universal utility to mankind. They furnish thatching for houses, brooms, baskets, hats, matting, cordage, twine, thread, writing material, oil, soap, candles, resin, wax, food of the nut or kernel and sago, milk, flour, salt, cement, cabbage, dragon-blood and paint, sap, tannin, yeast, palm-wine toddy, arrack, treacle, sugar, and many other things.

We will now speak of the "cycas" form. Some would say that it resembles a turnip; but, in truth, it merely looks like it, for the turnip is dicotylodonous and exogenous; has netted-veined leaves, a tap-root, and belongs to a class of vegetation possessing hardwood stems, with concentric annular rings of growth, and a true bark, composed of several coatings.

Palm plants do possess intimate analogies to the common onion, which is monocotyledonous, endogenous, has parallel-veined leaves; no true bark; no consecutive rings of hard, woody matter; no radiating medullary rays.

In Florida we have the saw palmetto (*Sabal Serrulato*), the prickly palmetto (*S. hystrix*), the cabbage tree palmetto (*Chamœrops palmetto*), the royal palm (*Oredoxa regia*), the cocoanut tree (*Cocos nucifera*), the dwarf palmetto (*Sabal Adansonii*), and the date palm (*Phœnix dactylifera*).

Mr. D. L. James informs me that the date palm is found growing at St. Augustine, Fla.

The saw grass palmetto possesses a trunk about the size of a fence rail, which lies prone upon the ground, so that traveling in a wagon over a new road in Florida nearly jolts the life out of you.

The rattan is of great use in chair-making—comes mostly from China. It possesses long, slender stems, with hard, glossy, silicious epidermis. The leaves are pinnate; grow with some distance between the nodes, often terminate in tendrils. The slender stems, which are sometimes 500 feet long, cling to neighboring trees. These stems look like cordage, and are used by the people of India in catching elephants.

This plant forms the connecting link between the gramineous plants and the palms.

The royal palm (*Oredoxa regia*) I found growing luxuriantly at Cape Sable, the extreme southern point of Florida. It has pinnate leaves, and the trunk is from 60 to 100 feet in height. The wood, when dressed and varnished, is often made into billiard cues and walking canes. Some of the cycas-

formed palms, as well as the tree-formed, furnish the sago, which comes from the isles of the East Indian Archipelago. The interior of the plant is filled with pith, cellular tissue. The vegetable nutriment is provided for the maturing of the fruit; for as soon as the fruit begins to form, the store of fecula disappears, leaving quite a hollow stem. This fecula is formed into round, transparent, bead-like grains by an artificial process, and comes into commerce as pearl sago, granulated sago, and brown sago.

The cocoanut tree (*Cocos nucifera*) is found as far north as Jupiter Inlet, near north latitude 27°, and I have collected the nuts at Key Biscayne, Florida, in north latitude 26°. It is maritime in its habitat. The trunk is from 50 to 80 feet in height, and generally slightly inclined; the pinnate leaves from 10 to 15 feet in length. There are from 10 to 12 nuts in a bunch, which grow close to the crown of the tree, just underneath the leaves. There are from 8 to 12 bunches produced on a single tree, and the nuts are ripening every month in the year. Those nuts nearest the tree ripen first and drop off. The nut is inclosed in a long, boat-shaped, three-sided husk, which has a smooth, yellow exterior. Often the ripened nuts fall into the sea, and float away to distant shores. If, while floating, the nut commences to germinate, the plumule pushes its way to the far end of coir fibre; it makes its side of the nut heavier, so that the shoot floats under water, where, being shaded and cool, the process of germination is retarded until the nut may chance to be cast ashore, where it can vegetate and become a magnificent tree, furnishing food and shelter.

The white, solid cone at the apex, when cut transversely into thin slices, is so much like "cold slaw," that few persons would perceive any difference either in appearance or taste.

When our ships visit the southern isles of the Pacific, the little Indian children, of three years of age only, impelled by a spirit of curiosity and adventure, swim off to the ships, buoyed up with one hand supported on an unhusked cocoanut.

The cocoanut may have furnished the means to discover America by emigration from the Polynesian Islands. The bread fruit and the cocoanut furnish food that would keep for a voyage. It is well canned by Nature, and the calabash furnishes a natural cask to preserve a supply of fresh water. Thus equipped for a voyage, the South Sea Islanders may have anticipated Columbus, and Aztecs and Mound Builders owe their appearance in America to the assistance furnished them by the cocoanut palm.

In the cocoanut tree, the flowers come out in clusters round the summit

of the trunk, enclosed in a spathe or sheath. The staminate flowers are nearer the top, and the pistillate nearer the bottom of the same spadix, and both are sessile. The staminate flowers have a three-leaved calyx, a three-petaled corolla, and six stamens. The pistillate flowers have three sepals and three petals, with three sessile stigmas. The flowers are of a pale yellow color.

The drupes are fibrous; there are from 12 to 20 in a bunch. They are at first green, then orange, then brown, when mature. The nut is familiar to all. It has three round scars at the base, out of one of which the embryo plant shoots forth.

The vernation of the cocoanut tree can be best described as consisting of a great number of cones formed around a common axis and fitted compactly one on top of the other, beginning with one of extreme minuteness, which is situated exactly at the apex of the trunk of the tree.

The phyllotaxy of the palm plants is typified in a fossil belonging to the carboniferous age, called *Archimedes*, and in living mollusks by the *Turritella* and *Scalaria*. If you conceive of a vertical axis, with an inclined line touching it, and gradually ascending with a uniform motion, the free end revolving in space about the vertical axis, the line thus moving will generate a helicoidal surface, and the point, or moving end of the line, will generate a helix. Upon such a helix the leaves on the trunk of a palm tree are arranged.

This spiral formation exercises a dominant control in the formation of fish, birds and animals.

In many monocotyledons, as in the maize, in all grasses, in spider-wort, bell-wort and iris, the numerical symbol is the fraction $\frac{1}{2}$, in which the numerator expresses the number of turns around the stem for completing one cycle, or set of leaves, while the denominator expresses the number of leaves in the cycle.

The general form of the palm carries us back to the fern trees of the carboniferous age, which Caruthers suggests as foreshadowing the monocotyledons, and also the dicotyledons, "and that they are probably the progenitors, not only of the tree ferns of the present day, but also of the palms and the foliferous exogens."

Le Conte's drawing of an ideal section of the Lepidodendron, displays distinctly the manner of growth of the vascular bundles from the central axis of the tree toward the base of the leaf petioles on the periphery. (See Figure 1.)

a=pith.
b=vascular cylinder.
c=bark.
d=rind.
e=base of petioles.
f=vascular threads.

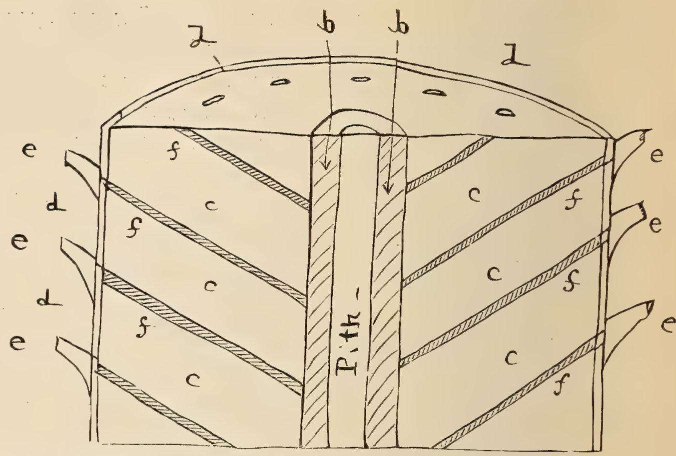
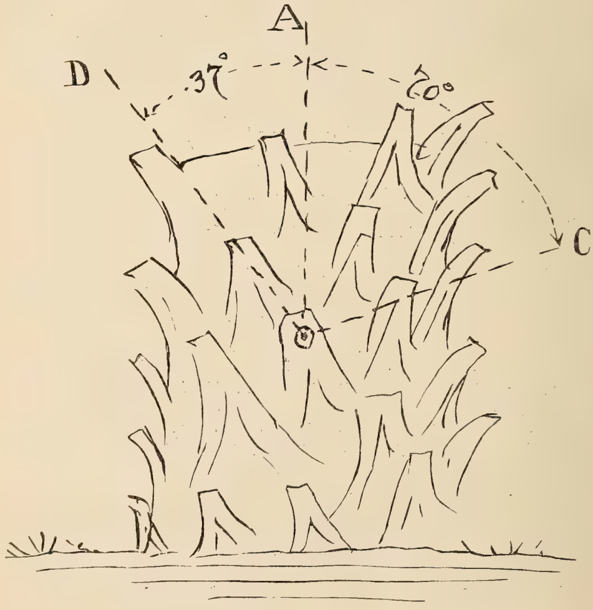


Figure 1.—Ideal Section of Lepidodendron.—After Joseph LeConte.

In a drawing of the same kind of tree by J. D. Dana, the phyllotaxy is beautifully shown (in the Halonia pulchella). The helix ascending



A B C=an angle of 70°.
A B D=an angle of 37°.

Figure 2.—Chamærops Palmetto.—J. W. A.

The ascending helix of leaf growth makes an angle of 70° with the axis of the trunk. The transverse helix makes an angle of 37°.

toward the right, makes an angle with the axis of the stem of 38°; the helix ascending toward the left, an angle of 25° with the central axis.

In the palmetto, the angle ABC, is 70°, the angle ABD, 37°. (See Figure 2.)

Desfontaines showed that the vascular bundles which run to the leaves, come from the centre of the stem, in the date palm, and in monocotyledons. Decandolle adopted this theory, while Molenhauer declared positively against its being a truthful conclusion.

One thing is certain; we find the leaf-bud starting at the very apex of the central axis of the cylindrical stem, and the matured leaf finds its final resting place on the exterior of the trunk, and on the ascending helix—the vascular fibres which run to the petiole of the leaf must necessarily be bent from the centre of the cylinder to the circumference, in order to adapt themselves to the movements of the growing leaf. Von Mohl states that the bundles of vascular tissue start from the periphery of the trunk, incline very gradually toward the central axis, then, by a marked curvature turn outward—toward the leaf stems. Thus it occurs in tracing the bundles upward.

"The vital or milk vessels for sap in the vascular bundles run from the periphery toward the central axis of the stem, thence to the leaf. The 'proper vessels' convey clear sap, and lie isolated in the interspaces of the cellular tissue, in the vicinity of the vascular bundles in the pith. The milk vessels, or vital sap vessels, exist independently, each set of vessels conveying wholly different sap."

Speaking of the two kind of vessels for conveying sap in monocotyledons, Von Mohl says, "These vessels (the milk vessels) then, are distinguished from the proper vessels (vasa propria) in the vascular bundles, by their different situation and by the red color of their contents, which color is never assumed by the sap of the proper vessels.

"The proper vessels in the vascular bundles of Sagittaria are no less clearly distinguished from the milk vessels lying scattered in the parenchyma of the peduncle and petiole, for the latter convey milky sap; the former very transparent sap."

I can not conclude without inviting the attention of our citizens to the necessity of a Botanic Garden in Cincinnati. I have not time to dilate upon its vital importance in connection with the pursuits of medicine, agriculture, horticulture, dyeing and weaving—or in inventing patterns for textile fabrics, and for the decorative arts.

The Moors, who excelled in their colors and arabesques, established magnificent gardens on their first entry into Spain.

In France, at Paris, plants were cultivated to serve as patterns to Court embroiderers.

In Europe generally, so universally acknowledged is the value of botanic gardens for the culture and industrial education of the people, that scarce a city of any size, is without its public garden. Even the antagonistic climates of St. Petersburg, Moscow, Warsaw and Finland have been noted for their botanic gardens. We should have them as adjuncts to the Zoölogical Garden and the Cincinnati Museum.

That great and noble patriot, Washington, shortly previous to his death, wrote to Congress recommending the establishment of a university at the Seat of Government; and in this document he said: "I conceive that a botanical garden would be a good appendage to a university."

Mr. George P. Handy was proposed for regular membership.

Prof. A. D. Morrill was elected a regular member.

The Secretary stated that the communication of Mr. Charles Dury, received at a late meeting of the Society and referred to the Executive Board, had been received by the Board and a committee appointed. The Board of Exposition Commissioners had resolved to donate a large collection of Colorado minerals to the Society, and they would soon be in the museum.

The Custodian stated that the collection consisted of a large mass of material, chiefly ores from Colorado, and would be examined and sorted as soon as possible.

The donations for the month were announced as follows: From D. L. James, Reports of Commissioner of Indian Affairs, 1863–1869; seeds of *Anemone Virginiana, Gleditschia triacanthos;* from Thomas Paxton, *Bubo Virginianus;* from W. W. Thompson, Proceedings of American Association for the Advancement of Science, 1883; from J. Ralston Skinner, Stevens' Flint Chips; from Chief Signal Officer, Monthly Weather Review August, 1884; from S. T. Carley, three species of shells; from Central Ohio Scientific Association, Proceedings, Vol. I., Part 2; from U. S. Naval Observatory, Vol. XXVII. Astronomical and Meteorological Observations; from Mrs. May and Miss Virginia Bowers, War Club from Sandwich Islands; from G. Kjerulf, Pods of Cotton; from U. S. Fish Commission, Bulletin, Vol. IV., Nos. 23 to 29; from Nelson Perry, Specimens Native Silver and Gold from Mexico; from J. B. Peppers, specimen of Spider; from Cincinnati Exposition Commissioners, Specimens of Gold, Silver and Copper Ores, etc., from Colorado, Arizona and New Mexico.

TUESDAY, *December* 2, 1884.

Vice President Harper in the chair. Twelve members present.

The following paper was read and referred to the Publishing Committee:

THE AZTEC CALENDAR STONE.

BY JAMES W. ABERT.

Many years ago, when just from that most excellent school, the U. S. Academy at West Point, I was looking over an old portfolio, and there found two engravings which attracted my notice especially. The first was marked in Spanish, "Reloj solar meridional que usaban los antiguos Mexicanos," and represented the horizontal projections of the construction proper for a solar dial. The second was marked, "Lamina III.," and was a drawing of the famous Aztec Calendar Stone, a perpetual calendar used by the people of the great Montezuma, whom Cortez conquered, and whose historical and ethnological records the Spaniards so ruthlessly destroyed in the flames, incensed by a wild enthusiasm to obliterate all traces of heathen idolatry and the cruel customs and bloody deeds of human sacrifices.

With great care I have always preserved these random drawings, and you can judge of my delight when, a few weeks since (the 10th of November), I was rewarded for my care by finding in a rare old Spanish book a complete description and explanation of this identical engraving of the Aztec Calendar Stone. The book is by Don Antonio de Leon y Gama, published in Mexico in 1792. The author proves to be an astronomer of note, and a man familiar with the ancient language of the Aztecs, as well as one deeply skilled and interested in the ancient lore of the Mexicans. It was by the means of excavations, prosecuted at the suggestion of Gama, that many valuable memorials, together with the great stone, were discovered on the 13th of August, 1790—a memorable day, as it was the anniversary of the very day on which Cortez took possession of the City of Mexico, in the year 1521.

Gama's works have been quoted by many of the most skilled savans since his day, as Humboldt, Lord Kingsborough, Gallatin, and the latter says: "Since all other systems are proved to be erroneous, and that of Gama is alone consistent with itself and sustained by the proofs which have been stated, it has in its favor the highest degree of probability of which the case is susceptible."

The Calendar Stone (Plate X) was discovered buried under ground in the great plaza, or square, of the City of Mexico, near the site of the temple

of the Aztecs. Though somewhat mutilated, it is almost a perfect square in form, and consists of a circular cylinder, raised in relief of eleven inches beyond the remaining surface of the stone, which is four and a half Spanish yards in width, one yard (vara*) in thickness, and, according to Lord Kingsborough, weighs fifty tons.

In the office of the Topeka & Santa Fe Railroad Company, No. 159 Walnut Street, there is a large photographic copy of this stone, but the carvings have been much defaced since Gama first saw it, and, most fortunately, had accurate drawings made of its marvelous hieroglyphics.

The surface of the stone is covered with concentric circles, inclosing figures, which refer to the several motions of the sun, and to some of the Mexican festivals and ceremonials which were celebrated at the periods included between the vernal and autumnal equinoxes.

It has been ascertained that this stone was constructed and placed in a Mexican temple but a few years previous to the conquest, and during the reign of the last of the Montezumas.

The great Calendar Stone now stands fixed in the wall of the Grand Cathedral of Mexico.

The principal figure represents a human face, with the tongue hanging out, inclosed by a circle seven-eighths varas in diameter. The circle exterior to this is one and five-eighths varas in diameter, and it incloses four square-framed hieroglyphics, which refer to the four seasons, and to the legends of the sun's four destructions.

Around the principal central figure of the sun and the seasons, the next circles inclose the symbols of the twenty (20) days of the month, each of which has a special symbol and a special name, as follows:

1. Cipactli—sea monster.
2. Ehecatl—wind.
3. Calli—house.
4. Cuetzpalin—lizard.
5. Cohuatl—serpent.
6. Miquiztli—death.
7. Mazatl—deer.
8. Tochtli—rabbit.
9. Atl—water.
10. Itzcuintli—dog.
11. Ozomatli—ape.
12. Malinalli—grass.
13. Acatl—reeds.
14. Ocelotl—tiger.
15. Quauhtli—eagle.
16. Cozcaquauhtli—vulture.
17. Ollin—sun's movements.
18. Tecpatl—flint.
19. Quiahuitl—rain.
20. Xochtli—flower.

These symbols are arranged in such order of sequence that, beginning at the upper rim of the circle, you move around successively to the left, as is

*The vara is equal to 32.9 inches.

indicated by the numbers, ranging from 1 to 20. The next circles exterior to those containing the days of the month, you find fifty-two small squares, but only forty are sculptured, as three are considered to be concealed beneath each of the four chief cardinal points, which would make fifty-two squares in all;* and each of these fifty-two squares contains five figures for days, which, Gama states, as representing the period of 260 days, twenty of the first, or moon reckoning "trecenas," or thirteen days. $13 \times 20 = 260$.

The whole circle is divided into eight angular points R, which designate the eight principal times of the day. The intervals between these are again divided by small circular symbols, designated by the letters L, which designate the hours of the night. At the top of the stone is the symbol of a bunch of reeds and thirteen roundlets, to designate "13 Acatl," which shows that this stone applies to that year.

Mr. Gallatin conjectures that this symbol must have been solely for astronomical purposes, while Gama presumes that it was on account of its being the twenty-sixth year of the circle, equally removed from the beginning and the end. It certainly was not intended to designate the year that the stone was brought to Mexico, for no year of "13 Acatl" occurred during the reign of Montezuma.

The smaller interior image, as we have already stated, is the image of the sun and the four parallelogrammes, A, B, C, D, containing respectively the hieroglyphics of the days 4 Ocelotl, 4 Ehecatl, 4 Quiahuitl and 4 Atl. The lateral figures, E and F, according to Gama, represent two great astrologers, "Cipactonal" and "Oxomoco," husband and wife, who were represented in the shape of eagles and owls, and who are said to have invented this stone and caused it to be sculptured.

This representation of the sun, with the accompanying parallelogrammes, is named "Ollin" (according to Gama). The Mexicans believed that the sun died four times, and that the one that now shines is the fifth, also doomed to destruction. From the first creation, the first age and the first sun endured for 676 years, or thirteen cycles, when the crops failed, and men were devoured by tigers. This took place in the year 1 Acatl, and on the day 4 Ocelotl, when the sun died. This destruction lasted thirteen years. The second age and sun lasted 364 years, or seven cycles, and ended in the year 1 Tecpatl, on the day 4 Ehecatl, when the destruction was caused by high winds and hurricanes, and some men were changed into monkeys. The third age lasted 312 years,

*They had 52 years in their cycle.

six cycles; when, in the year 1 Tecpatl, on the day 4 Quiahuitl, the destruction was caused by fire and earthquakes, and men were changed into owls. The fourth age lasted 52 years, when, in the year 1 Calli, on the day 4 Atl, the world was destroyed by the flood, and men were changed into fishes. After all these terrible convulsions of Nature had subsided, the gods created the existing fifth sun and fifth moon. The four eras of destruction are precisely those symbolized in the four parallelogrammes, A, B, C, D.

From the Mexican Almanac, according to Gama, we find that* the letter "A" designates 4 Ocelotl, the 17th of May; the letter "C," 4 Quiahuitl, the 27th of July. These are the dates of the sun's zenith transit at the City of Mexico.

"H" designates 10 Ollin, the 22d of September; "N," 1 Quiahuitl, the 22d of March, and "M," 2 Ozomatli, the 22d of June.

And Mr. Gallatin says: "We have on this stone the dates of the five principal positions of the sun from the vernal to the autumnal equinox. Three of these, the two transits of the sun by the zenith and the autumnal equinox, are Mexican days, on which these phenomena occurred in the first year of the cycle (1 Tochtli); and the two others, the vernal equinox and the summer solstice, are the Mexican days on which these two phenomena occurred in the year 13 Acatl.

"These dates are not founded on conjecture, nor derived from Indian paintings no longer to be found, or of a date subsequent to the conquest, or from the uncertain indications given by the Indian writers who wrote with our alphabet either in Spanish or Mexican language. They are positive facts, engraved by the Indian priests before the conquest, on a stone monument of indubitable authenticity."

Mr. Gallatin says that it is highly probable that these mythological representations are connected with celestial phenomena. "And it is found accordingly that the days designated in the parallelograms A and C as 4 Ocelotl and 4 Quiahuitl, correspond respectively to the 17th of May and the 27th of July, and these two days are those of the transit of the sun by the zenith of the City of Mexico, which is situated in north latitude, 19°, 25′, 57″, and in the longitude, 101°, 25′, 20,″ west of Paris."

Every date inserted in the Calendar Stone refers to the period from the vernal to the autumnal equinox, and the days agree with those that all astronomers now assign to them. And Gama concludes that a stone some-

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* See Trans. Am. Ethnological Society, Vol. I, p. 98, and Table C. The dates are according to our calendar.

what similar to this one, but representing the other half of the ecliptic, is yet to be found.

There are certain holes near the edges of the outer cylinder of the Calendar Stone. These holes are drilled so as to be perpendicular to the face of the stone, and are designated by the letters X, Z, and S, V, P, P, and Q, Q, which correspond nearly with the subdivisions of the circle into eight parts, designated by the letters L, L.

The stone was placed in a vertical position, parallel to the prime vertical plane (*i. e.*, due east and west), and facing to the south, and Gama states that they fixed two gnomons of equal length into the holes, X and Z; also two of equal length, but longer than the first two, at S and Y; the difference in the two sets of gnomons was made equal to that which exists between the zenith of Mexico and the Tropic of Cancer. Threads or fine cords were stretched through the ends of each set of gnomons, hence, the shadow of the upper thread (on the day of "ce Ozomatli" in the year 13 Acatl), or on the 22d of June. When the sun attains its highest declination, the shadows of these threads will coincide in a due east and west line upon the face of a horizontal plane, and the angle formed by a plane containing the threads, with the equatorial plane minus the angle P E Z, will give an angle equal to the latitude of Mexico. (Fig. 1.)

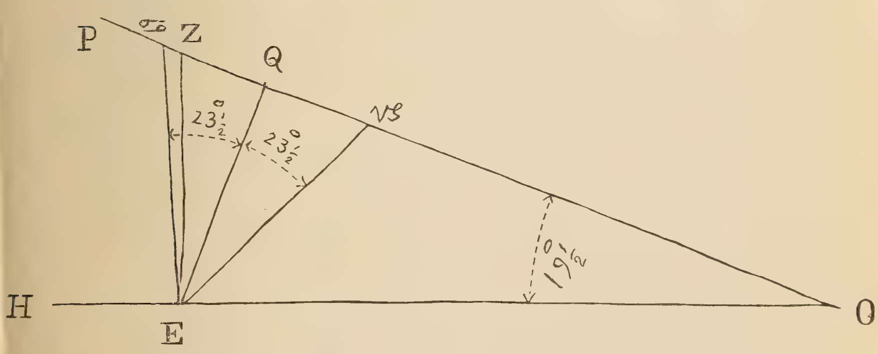

Figure 1.—Diagram showing sun in the zenith on May 17th and July 27th.

Or, the gnomons may have been arranged of such relative lengths, that, at the equinoxes, the plane of their shadows would coincide with the equatorial plane, and then the angle made with the face of the Calendar Stone (*i. e.*, Q E Z), would give the latitude of Mexico.

The other four holes, equally distant, are P, P, and Q, Q, which answer the purpose of holding four gnomons of equal length; through the ends of each pair threads were stretched horizontally, the thread P, P, over the thread Q, Q, and in the same vertical plane, at right angles to the merid-

ian, and passing through the zenith. The coincidence of the shadows of the two threads would make known the day when the sun was in the zenith, in going from the equinoctial to the Tropic of Cancer, and again, when the sun returned to the equinoctial; for in those two days the shadow of the upper thread would exactly coincide with that of the lower, precisely at the moment of mid-day. This occurs on the 16th or 17th of May (the day *Naui Ocelotl*) when the sun passes first through the zenith, and the second time, 26th or 27th of July, (the day 10 Cohuatl.)

By means of the shadow of the upper thread, P, P, they knew exactly the day of the "Trecena," which was dedicated to the sun, on which occasion they celebrated grand festivals, which were left to the charge of the priest or principal minister (*Ep cou qua cuilt zin*), the master of ceremonies. They well knew that at the end of one of their cycles of fifty-two years the civil year had receded thirteen days, and in order to equalize it to the solar year, they intercalated those days. It was easy for them to ascertain, in any year, how many of these thirteen days they must take into their reckoning, in order to verify the precise time of the equinoxes, and solstices, and transits of the sun through the zenith.

This stone also served as a solar dial, and in addition to its marking noon by the vertical and parallel shadows cast by the gnomons, X and Z, they also pointed out the hours of nine in the morning and of three in the afternoon; times which they particularly observed for their rites and ceremonials. The hour of nine was marked by the shadows of the gnomon Z when it passed along the left edge "z" of the frame of the "Ocelotl," and through the middle of the circlet "g" in the circle of the sun, and along the right side "s" of the frame of Quiahuitl, and coinciding with the lower gnomon S. In the like manner the shadow passing along the right side of the frame of Ehecatl at "s," and through the circlet "y," and through the left side at "h" of the frame which includes the symbol "Atl," and thence continued through gnomon Y, in the lower part of stone, this shadow would point out the hour of three in the afternoon.

The Mexicans also took account of the times of the night, especially of the hours of nine in the evening and three in the morning; which hours they knew from the rising and culmination of certain stars, according to the time of the year, as is ascertained from what has been stated by both Torquemada and D. Hernandez. They expressly state the hours in which incense was daily burned to the sun, and sacrifices offered up.

This stone was destined for other purposes, in addition to those which we have stated, but as little has been narrated on these matters in the histories, we could not find out very much about them. It has been ascer-

tained that by its means they regulated the festivals of the moon, and by its means they determined the days of "Tonalamatl,"* and arranged the days of their "Second Calendar" (the moon calendar) in sets of thirteen, corresponding to its phases, by night and day, under the title of *sleeping* and *waking* of the moon; which intervals they designated by the word "Metztli," a name appropriated to the moon; and to the period of the 260 days, the name of "Metztla, pohualiztli," or reckoning of the moon.

By the means of the gnomons and shadows of the threads, they made observations in regard to the rising, setting, and culminations of the moon; thus they obtained minute knowledge of the movements of the moon, to which they offered the same veneration and worship as to the sun, and to which they had dedicated a beautiful temple named "Tecuiccizcalco." It was built of shells.

The magnitude of this stone, and the art necessary to transport it from the locality or the quarry to the place where it was put into position have filled many persons with astonishment, and there has been much discussion in regard to its weight. In Lord Kingsborough's works the weight is stated at fifty tons. In moving it they supplied the want of cars and other wheeled vehicles by loose cylinders of wood, by the means of which they moved and actually did transport for considerable distances bodies of great weight and volume, simply by changing the position of the cylinders or rollers.

It may appear astonishing, nay, almost incredible to some persons, that what we call semi-civilized nations, such as the Egyptians, Peruvians, Hindoos and Mexicans, should possess such a marvelous amount of astronomical knowledge, and of such minute exactitude, in regard to the movements of the sun, the moon, and the stars, together with the inclination of the earth's axis and the construction of dials; truly, it seems most marvelous that all this should be attained without the aid of such refined astronomical instruments as we now possess. But the great point of distinction to be noted is the freedom from the necessity of this kind of knowledge among nomadic people, and the absolute necessity of possessing it among all those who build permanent towns, who erect solid structures, which give a fixed and permanent basis from which to begin observations. The foundations for observations once laid, the first steps are taken which serve to traverse the gulf between ignorance and knowledge, and the progressive improvement is made—surely it may be, certainly it must be.

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*Tonalamatl means the table of the Commandments of God or of the sun.

To know how much may be achieved with the simplest instrumental appliances, we need but read the description of the Portable Dial, of Ferguson, given in the Encyclopædia Britannica, where you will see that by means of a pasteboard card and a simple plumb-line—which by the way is one of the most exact lines of reference the most refined astronomers can obtain—with these simple means you can work out five valuable astronomical problems.

As, I. To find the hour of the day.
II. To find the time of the sun's rising and setting.
III. To find the sun's declination.
IV. To find what day the sun enters a "Sign."
V. To find the meridian altitude of the sun.

In order to demonstrate what scientific skill the Mexicans displayed in order to make accurate observations, on the celestial bodies, I herewith call your attention to the drawing of an astronomical observatory, which you will find in Lord Kingsborough's works, No. 72, Plate 24, Vol., IV, Wm. Dupaix's collection. (Fig. 2.)

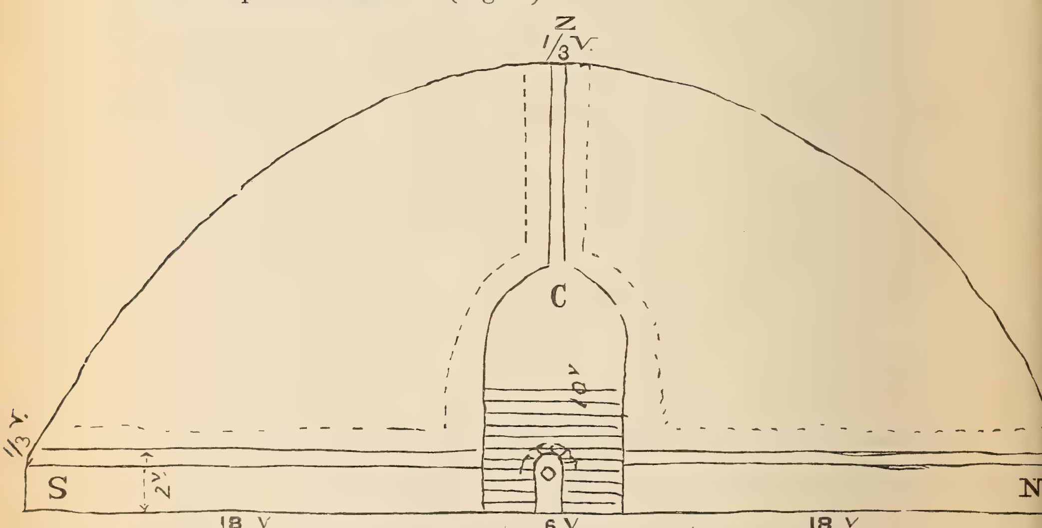

Figure 2.—MEXICAN OBSERVATORY.—From Lord Kingsborough.

Main chamber square. S–N—Tubular passage running north and south. O—Passage running east and west. C–Z—Vertical passage. V—Signifies a *vara* (32.9 inches).

A rectangular chamber is seen, six yards wide and ten yards high, intersected by two passages, at right angles and oriented; one six feet high by three feet wide, the other cylindrical, and only one foot in diameter, its top six feet above the floor, and also due north and south, *i. e.*, in the

plane of the meridian. By the means of this tubular passage they could take observations upon the culminations of the sun and moon, by using a mirror of mica or obsidian, to get the reflection of the rays to be visible through the long narrow aperture. The passage at right angles was used to obtain entrance or exit to the main chamber, and doubtless it served to obtain observations on the sun at the vernal and autumnal equinoxes; and there is seen also a tubular vertical passage of one foot in diameter, which served to observe the two zenith transits of the sun.

It is worthy of especial notice that the arched roof of the main chamber is a groined arch, springing from the top of four walls of a square chamber. The arching of the horizontal passages, of the vaulted roof of chamber, and the wall of the vertical aperture for zenith observations, are all of some kind of strong cement, one yard in thickness. The lower half of the meridian passage and the walls of the chamber are made of dressed stone—a true stone arch is seen over the doorway at the entrance of the main chamber. The whole structure presents the appearance of a simple mound of earth, 51 feet high and 126 feet in diameter.

The horizontal passage being in the plane of the meridian, could not be well used, except by the aid of reflecting mirrors of mica or obsidian, by which means the movement of the sun to its maximum and minimum declination could be followed, and the light transmitted through the long, narrow, cylindrical aperture, and every meridian passage throughout the year could be observed. Dupaix speaks of this as "either a temple or mansion of the dead, for it might have served both purposes." You will also find a curious dome structure, with a vertical aperture, somewhat resembling the structure just described in this same work of Lord Kingsborough. (See Figure 34, Plate 16, Vol. IV., and description in Vol. VI., p. 420.)

While speaking of this singular building in which the true arch is seen above the doorways, I would call attention to some ancient bridges described by Dupaix. (See Lord Kingsborough, Vol. VI., p. 466.) In the province of Tlalcala are two stone bridges, one near Los Reyes, built of stone and cemented with mortar. "It has a sort of arch, which forms an obtuse angle, springing from two side walls or buttresses." It is seven feet high, seven feet broad, and has a width of forty-two feet. The other bridge, which is not far away, is one hundred and two feet long, thirty-six feet broad; its perpendicular elevation is sixty feet. Both bridges have four obelisks each, at their four angles, and are guarded by parapet walls. This "sort of arch" consists of large stones, about fourteen feet long, placed so that the ends abut against each other after

the manner of rafters; the thrusting weight is transmitted to the abutments; all that was wanting was the keystone to complete the perfect arch. (Fig. 3.)

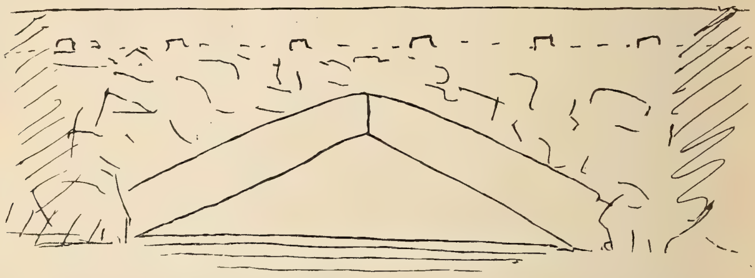

Figure 3,—STONE BRIDGE.—From Lord Kingborough's Mexican Antiquities.

The wheel sculptured stones are numerous. They all agree with the Calendar Stone, in having eight pointed rays and eight blunted rays, dividing the circumference into sixteen equal parts.

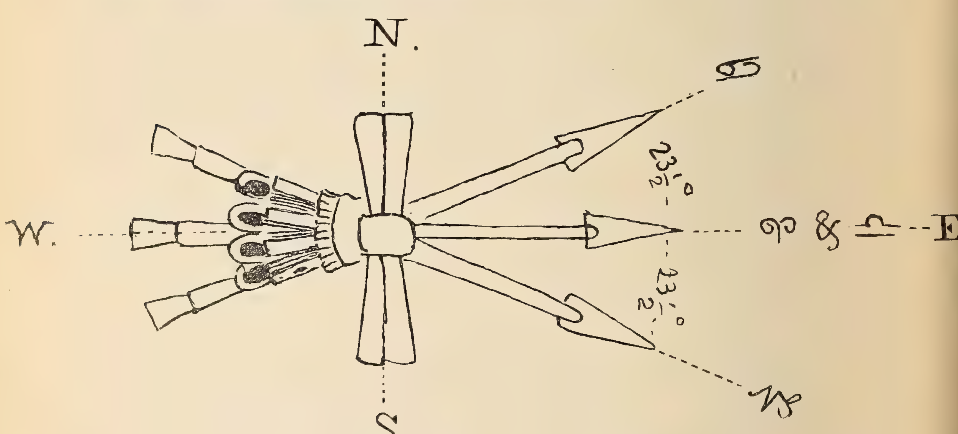

Figure 4.—The three arrows of Chapultepec. J. W. A.

There were also some very interesting stones found on the hill of Chapultepec, one of which had three arrows engraved upon its horizontal surface. The points of the arrows directed toward the east marked out the two solstitial points, and the middle arrow, which bisected the angle between the two others, pointed due east, to the equinoxial point; at the common point of intersection of the three arrows, there was a band which tied them together. There was observed a small line crossing its centre, and two

other stones were placed in a direction, one directly north, the other directly south, of this mark. The two had holes drilled in them to contain rods, to which a cord could be attached to serve for a meridian line, and and the three stones were so arranged that the shadow of this line would fall upon the mark of the band of the arrows at the instant of midday. (See Gama, p. 110.) The symbol of the three arrows is of frequent occurrence in Kingsborough's work. (Fig. 4.)

Having now given you some idea of the purposes of the Aztec Calendar Stone, I must here state that, in order to comprehend fully how to use it, you must understand their calendar and methods of reckoning time.

The Mexicans possessed two kinds of calendars, viz.: their civil calendar, or reckoning by the sun, and their religious calendar, or reckoning by the moon. Here we have a table of the Mexican half-century of fifty-two years:

1 TLALPILLI.		YEAR.	2 TLALPILLI.		YEAR.	3 TLALPILLI.		YEAR.	4 TLALPILLI.		YEAR
1	Tochtli,	1	1	Acatl,	14	1	Tecpatl,	27	1	Calli,	40
2	Acatl,	2	2	Tecpatl,	15	2	Calli,	28	2	Tochtli	41
3	Tecpatl,	3	3	Calli,	16	3	Tochtli,	29	3	Acatl,	42
4	Calli,	4	4	Tochtli,	17	4	Acatl,	30	4	Tecpatl,	43
5	Tochtli,	5	5	Acatl,	18	5	Tecpatl,	31	5	Calli,	44
6	Acatl,	6	6	Tecpatl,	19	6	Calli,	32	6	Tochtli,	45
7	Tecpatl,	7	7	Calli,	20	7	Tochtli	33	7	Acatl,	46
8	Calli,	8	8	Tochtli,	21	8	Acatl,	34	8	Tecpatl,	47
9	Tochtli,	9	9	Acatl,	22	9	Tecpatl	35	9	Calli,	48
10	Acatl,	10	10	Tecpatl	23	10	Calli,	36	10	Tochtli,	49
11	Tecpatl,	11	11	Calli,	24	11	Tochtli,	37	11	Acatl,	50
12	Calli,	12	12	Tochtli,	25	12	Acatl,	38	12	Tecpatl,	51
13	Tochtli,	13	13	Acatl,	26	13	Tecpatl.	39	13	Calli,	52

In this they use four symbols only, but since 4 and 13 are incommensurable, no confusing repetition could occur until fifty-two years have elapsed.

The religious calendar, or reckoning by the moon, was used by the priests to regulate their ritualistic festivals. It consisted of "trecena"—periods of thirteen days—and twenty hieroglyphics for the days of the months, by which a cycle of 260 days was formed ($13 \times 20 = 260$). This period formed the religious year. Seventy-three periods of 260 days amounts to 18,980 days, the precise number of days in their half century of 52 years.

The civil year contained eighteen months of twenty days, divided into four weeks or periods of five days each. Every fifth day was a grand market day and a day for festivals.

As the religious year of 260 days required 105 additional days to equalize it with the civil year, the Aztecs used a third series, in order that the

repetition of the same numbers should be capable of being distinguished. This third series consisted of nine hieroglyphics called "Lords of the Night." The use of this new set of symbols would prevent them from falling into any confusion, caused by the repetition of the same terms for the additional 105 days which must be added to this period of 260 days in order to complete the religious year, or "moon year," and make it commensurate with the civil year, or "sun year."

The Mayas had calendars composed in the same manner as the Mexicans, for their year was made up of eighteen months of twenty days each, with the addition of five epagamenon, and their cycle of 52 years was composed of four differently named years, arranged in sets of thirteen, and four times repeated. "A cycle of 52 years was thus obtained in a manner almost identical with that of the Aztecs, Tarascos and other nations." (See Dan'l G. Brinton.)

One is struck with wonder in considering the high attainments these people had made in astronomical knowledge. Where they originally obtained it, is as yet a mystery. But one thing seems certain, that all the civilization of our American Indians must have originated at the great focus of Indian civilization.

"It is believed by Baron Humboldt, and by others, that in the Navajoes and Moquis, we see the descendants of the same race of Indians which Cortez and the Spanish conquerors found in Mexico in a semi-civilized state. The whiteness of their skins; their knowledge of useful arts and agriculture, and the mechanical skill exhibited in their edifices at the present day bear a striking analogy to the Mexican people at the period of the conquest; and, as Humboldt says, 'appear to announce traces of the cultivation of the ancient Mexicans.' . . . We are tempted to believe that, at the period of the migration of the Toltecs, the Acolhues and the Aztecs, several tribes separated from the great mass of the people to establish themselves in these northern regions."

Then from the Aztecs this civilization was spread abroad by the intercourse of trading, and also by means of couriers, or runners, who answer to our mail carriers.

The City of Mexico constituted the grand centre, from which irradiated the best and the highest culture which could be obtained by any of our Indians, and when we desire to investigate any of the subjects connected with them, and trace them to their sources, I believe that we should go to the nations of Guatemala and Mexico.

At the conclusion of the paper, which was illustrated by a large drawing of the Calendar Stone, remarks were made by various members of the Society.

Mr. George P. Handy was elected a regular member.

Messrs. Samuel R. Singer, George B. Twitchell and Rev. Raphael Benjamin were proposed for regular membership.

The following resolution, recommended by the Executive Board, was submitted to the consideration of the Society:

"*Resolved*, That the Amateur Photographic Club be granted the use of the meeting room of the Society one evening each month, this permission to be subject to the approval of the Society at large."

Dr. Dun, on behalf of the the club, stated that it desired some place in the city where it could hold monthly meetings; that it was able and willing to pay for gas or fuel consumed, and that the meeting would be open to all members of the Society.

Dr. Langdon stated that if the grant was made, it would open the way for any or all clubs or associations to make similar applications, and entitle them to expect similar privileges. He thought, too, that the privilege should not be granted for an indefinite period of time.

Dr. Dun then amended the resolution to read that the room be granted to the club "one evening each month for a period of six months."

After some further discussion, the resolution, as amended, was carried.

The Custodian called attention to a number of exchanges which were on the table. Among them was a set of the publications of the Geological Survey of Canada, a valuable addition to the library; also a set of plants and sections of woods from the West Indies, and forty-one species of fossils from the Cincinnati and Trenton groups.

Donations were announced as follows: From Bureau of Education, Annual Report of the Commissioner for 1882–83; from Davis L. James, Ohio Statistics for 1859, 1873 and 1878; from Chief Signal Officer, Monthly Weather Review for September; from U. S. Fish Commission, Nos. 30, 31, Title, Index and Plate of Vol. IV., Bulletin of U. S. Fish Commission; from U. P. James, four species (*Stromatopora tubularis*, *S. ludlowensis*, *Monticulipora falesi* and *M. ohioensis*) of fossils lately described in the Journal; from George W. Harper, two species of shells, and other specimens, from Peak's Island, Maine.

Adjourned.

*THE DEERCREEK MOUND.**

Report of Its Excavation and Location.

By Walter A. Dun, M. D., M. R. C. S.

On the 26th day of June, 1876, in company with Mr. Scott Cunningham, now a hardware merchant in Chillicothe, Ohio, I commenced the excavations, the results of which lie before you to-night.

The mound, which was the principal object of our work, was situated on a farm owned by Mrs. Heath, and located on the banks of Deercreek, nine miles from Chilicothe, and a few miles north of the road leading from Chillicothe to Clarksburg. The mound is located upon a bluff, which is composed of shale covered with a layer of clay and some drift, about two hundred and fifty feet high, and which forms a projecting promontory into the valley of the creek. The distance from the creek is about a third of a mile, down the precipitous shaly bluff and across a narrow strip of fertile black loam that lies on the level with the creek banks. Deercreek is at this point a stream of considerable importance. It rises in Clark County, Ohio, and after traversing the counties of Madison, Fayette, Pickaway and Ross for about a hundred miles, empties into the Scioto River about six miles below the situation of this mound. This portion of the stream is consequently extremely liable to rapid fluctuations from the rains falling in the various parts of its basin. The overflows at this point are frequent and damaging, and carry out into the narrow black loam of its valley a quantity of muscle shells, which appear in nearly every spadeful of earth; and, in various stages of disintegration, are becoming rapidly incorporated with the soil. The shale of the bluff belongs to the great shales of the Devonian age, and has undergone atmospheric disintegration at the exposures. The crown of this bluff is covered with a thick yellow clay containing small rounded peebles, so characteristic of the drift formation. From the north bank of the creek a broad first bottom extends for a couple of miles, and then merges into a country more rolling in character.

Covering the bluff and mound was the native forest undisturbed. Many trees, including some on the mound, were two or three feet in diameter, and no doubt dated back some centuries. The forest growth was so dense, on and around the mound, as to seriously obstruct the prospect from its summit. But here and there in the breaks of the foliage, the extent of

* This paper, by Dr. Walter A. Dun, was read at the meeting of the Society for January, 1884. It was referred to the Publishing Committee, but has been delayed until the present time.—Note by Editor.

the view could be realized if it could not be carefully noted. The smoke of trains, to the north, on the Muskingham Valley Railroad, distant about fifteen miles, could be easily seen, and thus the progress of the trains back and forth, from east to west, discerned for over an hour. The level country still further away and beyond the railroad, thickly crowded with trees extending for miles, beautifully bounded the horizon. The view from the summit of this mound, situated as it is in on a peninsular bluff, extends for miles to the west, north, northeast, east, and southeast. Mount Logan, near Chillicothe, about ten miles away, is visible, as also the range of hills extending northward to the east of the Scioto River. Mention has been made of this wide range of view, because of the fact, that a theory exists, that the mounds were used as places to build signal fires upon, in order to quickly carry alarm over a wide extent of country—a species of telegraphing which has been used by many nations, and even within a few centuries in Scotland. This has been very strikingly portrayed by Sir Walter Scott in his novel, "The Antiquary." It may, however, not be out of place to remark, that on the mound, at present considered, no evidences were discovered which would warrant the conclusion that it was over the seat of a single fire. Clay is noted for its baking properties, and although the summit had been disturbed and become the place of burial by some later inhabitants, still, evidences of a large fire *in situ* were entirely wanting.

The natural curve of the original stratum of soil, on which the mound rested, was slightly convex; sloping more rapidly and decidedly toward the side by the bluff, making it rather difficult to decide in that direction just where the mound ended and the original soil began. The measurements, as near as we could determine, were: circumference, 361 feet and a few inches; diameter, 115 feet; height, 33 feet. Calculations from these figures show that the area covered by the base of the mound was, 10,384½ square feet, and the entire amount of earth used in its construction was 114,229½ cubic feet. The mound was conical in structure, with a circular base, and the slope of the sides was about thirty degrees. Externally, the work seemed to be in an extraordinary state of preservation. The sides were steep, and what was to be especially noted, were not washed here and there into furrows and ridges by the action of rains and water. The roots of the immense trees and old decayed stumps had displaced the earth to a very limited extent, immediately about the point where they entered and buried themselves in the mound. An excavator had dug a hole in the north side, about half way up the mound and at a slight angle, to the depth of about eight feet. This was quite recent, and the man who

did the work told me he found only one flint arrow-point in that hole. The layers of the earth in this hole were dark and mouldy, but nothing else was apparent that related to the mound. A small and old depression was afterward found on one side of the mound about a third of the way down the side, which was undoubtedly at one time the external opening of a burrow of our common ground hog. (*Arctomys monax.*)

The large size of the mound and its height inclined us to the view that it belonged to the class known as sepulchral mounds. Following the usual plan,* we began to sink a shaft from the apex to the base. This shaft was circular in shape and six feet in diameter. The apex of the cone was so distinctively marked that a perceptible curve was embraced in the outline for the top of the shaft; all of which only shows the very fine state of preservation of this monument.

Throughout the valley of Deercreek, from the lower portion of Madison County, to its end in the Scioto Valley, a distance of over forty miles, are found many remains of the Mound Builders. These are numerous and close together at the lower end and richest part of that basin, and are scattered out and become separated by wider and wider distances as one ascends the creek.

From the top of this mound many earth-works and mounds, situated in the valley or on the neighboring hills, are easily seen, notwithstanding the fact that the tall trees and dense foliage of the native forest covering this mound, and the surrounding fields, obstructs by far the largest portion of the view. It may not be out of place to remark that the growth of timber and bushes at this place was such as to completely obscure the mound at the distance of a few hundred feet. In more immediate relation to this large mound are three or four smaller ones, varying in height from two to four feet. One of these smaller elevations is situated at the center of an embankment, of which only a semi-circle is built, the walls of which are three feet high, and the ends are separated by the diameter of the circle, which is fifteen feet. All these lesser earth-works are situated within two hundred feet of the base of the large mound, and are located further back from the edge of the bluff than the mound. They are, like it, covered and obscured from view by the dense undergrowth, so that you only see them when a few feet away. The small semi-circular embankment already described, with a small mound as its center, is situated around the portion of the small mound farthest from the large mound. No other works were discovered closer than half a mile, except those here described.

In the course of sinking the shaft the following points were noted:

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*That of Squier and Davis.

The work of excavation for the first six feet was quite easy. The earth was soft, easily crumbled, and was readily thrown out with a spade alone. Two feet from the surface we reached some human remains in a very poor state of preservation. Some bones of the feet, the upper ends of the tibia and fibula, and lower end of the femur, were all recognized, but crumbled away very soon. The other parts of the skeleton were not recognized, and either had never been buried here, or had so far disintegrated as to have escaped observation.

At the depth of six feet other human remains were found so far disintegrated as to be identified only by a portion of the temporal bone of the skull. Between these two remains, at the depth of about five feet, an angular piece of porphyry, polished on one side, and evidently a piece from a broken celt or ax, was found.

The loose character of the earth already alluded to began to change on one side of the shaft at the depth of five feet, while on other side it continued to the depth of six feet, where the human remains were found. The earth had been a yellowish clay, similar to that of the fields about the mound, and contained here and there remnants of charred wood and ashes, in very small fragments. This presence of small bits of charcoal and minute quantities of ashes was noted throughout the shaft, at all depths. No reddened clay, baked or partly baked, was to be found at all, either near or apart from these evidences of fire. The loose character of the soil began to change at the depth of five feet, and at the depth of six extended throughout the area of the shaft. The clayey nature was unaltered, but the layers were very hard and compact, and the stratification was more distinctly visible. The spade was now completely useless. A pick was necessary, and was found necessary throughout the future digging of the shaft. The clay soil seemed quite dry, and very hard; so that progress from that point was slow, tedious, and laborious. A hollow sound was also quite perceptible in the process of picking, and was remarked and speculated upon for some time. At the depth of ten feet another layer of soil was reached underlying what has been already described. It was darker in color, and seemed to be a mixture of the soils of the bluff and valley. In this layer, at the depth of twelve and one-half feet, a ground-hog hole was reached, and contained some of the bones of that animal, with others which were not identified. This was rather an astonishing depth for that animal to borrow, but no doubt is accounted for by the dry condition of the earth, and the ease with which the earth coming from the hole was disposed of, down the side of the mound.

At the depth of 15 feet, this layer of mixed earths ended, and one about

three feet thick, composed of yellower soil, was dug through. The clay soil then entirely disappeared, and a black, soft, easily-spaded soil, containing numerous specimens of the fresh water muscle, in a disintegrating state, followed. This layer was about six feet thick, and was underlaid by another of clay, similar to that on the bluff. This last layer was about one foot thick, and was underlaid by a cone-shaped cavity, containing the remains of a sepulchre, etc. The layer of clay immediately above this cone was extremely hard. It seemed to have the appearance of being wetted and then pounded down. It was picked through with the greatest difficulty. Above it, at the beginning of the layer of black soil, a piece of a meta-tarsal bone of a deer, very highly polished, was removed. By a short calculation it can readily be seen that the distance from the summit to the top of the conical cavity, in the centre of the base of the mound, is 25 feet. Before going further, I want to remark that there was no indication present of this mound having been erected at different periods. Had these layers been added one after another, with considerable intervals of time between, weeds, grasses, and other vegetation would have grown upon the first, and their roots penetrating some inches into the layer beneath, would have left their molds or themselves behind as evidence of their growth, and would have warranted the assertion that subsequent layers were added, with an interval of time between. No such evidences existed ; therefore it is but reasonable and rational to believe that all the various stata, or layers, were built with only slight intervals of time between their construction. This point is especially mentioned here, because an article published in the *Popular Science Monthly*, about two years ago, advanced the theory that mounds are the accumulated dirt of ages, to which every passer-by reverently added his quota, in a similar way to that of the ancient Celts, who thus added to their piles of stones, called cairns, erected over the graves of some esteemed men, and a custom which also existed in the State of New York among some branches of the Iroquois. Notwithstanding the plausibility of the theory, it is worthless, because it is directly contradicted by the facts, and is, therefore, of no consequence.

It is also proper at this point to consider, not only the fact that a very considerable amount of labor was required to erect this mound, but also to point out the fact that a very large amount of the earth used in its construction, viz. : the black loam, containing muscle shells, six feet thick, and probably, also, half of the mixed layer above it, was of soil which could only have been procured at some distance, the most accessible point being the narrow creek bottom at the foot of the bluff. How was that soil carried up the bluff, 250 feet high ? Why should they resort to the

valley for the black loam? The entire absence of washes on the outside of this mound, notwithstanding the action of the elements for several centuries at least, certifies the care taken in its construction, and suggests that it may have been covered with sod as a last layer.

The cone-shaped cavity at the base, which was perforated at its apex by the shaft, was about ten feet high, and contained the remains of a wooden vault, which had caved in from the top, falling on its contents and precipitating the earth for some feet above. In consequence it was largely filled with large lumps of broken clay. Hanging from the entire top of this conical cavity, wherever the space between its top and the loose dirt beneath permitted, was a peculiar form of plant life. Its roots were attached above, and it was pendant, small in size, long and hairlike, in some places being a foot and a half long. The color, upon first examination, seemed a brownish red, but upon closer observation, that was seen to come from the fact that the plant was dead. A few strands of this, in a large bunch, were found to present a peculiar, dull, bluish-white appearance, full of water, and rounded into a hairlike stem, with a peculiar, irregular, bulbous enlargement at the lower end. This plant seemed entirely destitute of chlorophyll, and belongs to the group of fungi. It is a rather remarkable fact that plant life should exist 25 feet from the surface of the ground, with a very limited supply of moisture, and with the absolute exclusion of light. It may be that in this plant we have the forerunner of that life which will exist when this whole earth loses its heat, or fails to receive its usual supply from the sun. This plant soon withered in sunlight, so that no careful examination has ever been made of it. The dried tufts are very brittle and difficult to preserve. A few fragments I am able to lay before you to-night, and to it call the special attention of the botanists. In the loose dirt on top of the vault, a flat piece of sandstone, octagonal in form, was found. Unfortunately, however, it was struck by a pick, so that one edge was broken off. This stone was very soft, and crumbled so much upon handling that its first beauty is somewhat marred. Below, at the centre of the base of this conical cavity, was the vault, into which the earth was precipitated when the wooden top decayed and gave way. When entirely cleared of dirt and debris, this vault measured: From east to west, eight feet; from north to south, five and one-half feet, and was four feet high. This vault had posts set at each of the four corners, and was oblong in shape. The measurements given are those taken from the outside to outside of the molds made by the original logs of which it was composed. The molds made by these logs were very perfect, and gave the size and character of the timber of which they were originally composed. All of these were

undressed oak logs, and one was one foot and three-quarters in diameter. Four short pieces of logs were set upright at each corner, and served to lock and strengthen the whole. The top had originally been made of split staves about six feet long, four inches wide, and two and a half inches thick. All the wood had almost completely decayed. A few chunks were taken out with that peculiar red color so often seen in logs in a forest, which are so far decomposed that they are falling to pieces. The vault contained the skeleton of a man about six and a half feet high, lying with his feet to the east and head toward the west. On the south side of the body, nine stone arrow-points were found. About the wrists a few dozen sea shells, and around the neck, and extending over the chest and below, was a string of beads made of parts of the conch shell. Nothing further was found. The floor of the vault was covered to the depth of two and a half inches, throughout its entire area, with very black soil, the evident product of the decay of the organic matter of the body, together with that resulting from what was placed in the vault along with the skeleton, not including the wood. Careful search was made for hair, cloth and other fragile articles of wear, but none were found. The skeleton itself was badly decayed, and only a few fragments of it were saved after the greatest care, patience and difficulty.

The Articles found in the Vault.

A brief consideration of various things found in this vault, or ancient sepulchre, seems appropriate now.

The arrow-points present many points of difference ; they vary in length, in the form of the cutting edges (some being straight, others curved), in the beveling and in the degree of skill which is manifested in their manufacture. This last point is called to your special notice, for it has been a reasonable presumption that a difference of skill was a proof that man improved in art as he progressed in civilization and experience; and, therefore, the one who made and used the ruder weapon was more ignorant than the one who made and used better weapons. It is probable that very great differences of skill could be relied upon as presumptive evidence of different people, with different skill, living at different ages, and so on. It will also be equally apparent to those of you who examine these specimens, that came from the same grave, that it is only when these differences in skill are *very marked*, that any such conclusion could be drawn.

It is also a very interesting fact that all the nine stone points found together in the vault, had the peculiar square barbs, and that the piece which extends backward from between the barbs on both sides, is made

and beveled to an edge, which, in some of them, is quite sharp. These points of similarity suggest that it may have been a tribal distinction. Dr. Hill, who, for nearly forty years unceasingly collected in this vicinity, told me that he had found that certain areas (approximately made) furnished almost invariably arrow-points of a peculiar form of barbing. This observation of Dr. Hill refers to the surface relics; yet, in conjunction with the fact just noted, is very interesting in this connection. The material of which these points are composed is flint. The largest is of a very beautiful milky, bluish-white color. These are usually called arrow-points. From their size and weight it has lately been asserted that they are too large and heavy for arrows, and that they must have been spear-heads. This view for the larger ones seems reasonable, and they probably once furnished the ends to spears.

Beads.—The sea-shell beads, which were perforated at their ends and formerly strung on strings, are (*Marginella florida*)—shells found along the shores of the Gulf of Mexico. They are very small—about a half inch long, and had, when first taken out, a polished surface and peculiar ivory yellow color. They must have formed tasteful ornaments as bracelets.

Wampum.—The long string of beads pendant from about the neck, was of the kind known as wampum. They were smallest near the back of the neck, and progressively increased in size until they reached the centre in front, where they met in quite a large one. They are composed of carbonate of lime, and are made from the conch-shell, though they are now much altered by age, so that the structure is detected with difficulty, and only after patient and careful investigation. There may be some of the smaller ones, which were made from the vertebræ of reptiles, but all the larger are from shells. A few of these beads of wampum show, in the drilled holes of their centre, the substance upon which they were strung, and the holes themselves do not bear testimony to any high degree of skill in drilling. They have been apparently strung upon a twisted string of some woody fibre, a small portion of which has been infiltrated by the lime of the disintegrating wampum, and thus preserved. Two beads are cemented together by lime, and when they were first taken out, numbers were found cemented together in rows of six or eight.

The octagonal flat piece of sandstone, already spoken of as found in the loose dirt above the vault, presents nothing of consequence except its form and crumbling condition. The latter is due to the action of fire, for the outside layers of it seem redder than those revealed underneath; yet no other evidences of fire existed in the locality where it was found except what has been already described, and we therefore conclude that the fire

that produced this change was at some other locality than in the mound. The molds of the logs, etc., of the vault in the adjacent earth, showed close packing from pressure or pounding.

SKELETON.—The bones were all in a very bad state of preservation; the fragments which were secured were held together only with the greatest difficulty, and by boiling in glue and varnishing afterward. This was done with the intent to supply the animal matter of the bones, which had long since disappeared.

Nothing could be noted about the injuries to the bones. One femur showed an old break near its middle, but that might have come from the caving in of the dirt from the giving away of the top of the vault. The size of the skeleton was remarkable only in length. The few bones secured do not show excessive development of processes, spines, ridges, lines, etc., for muscular attachment, and we can not say that the man was very strong. The height was considerably over six feet; enough to class him along with our tallest ordinary men of to-day. The skull was among the best preserved bones, and great care was used to keep it, as far as possible, intact. The whole, however, was quite fragile, and the occipital bone, buried an inch or two into the floor of the vault, stuck to that clay soil, and, being more brittle than the rest, broke into many fragments. Many of the thinner bones crumbled, and were lost; yet enough were saved to make a respectable showing, and to present some interesting features. The inside of the occipital bone was covered with a crystalline substance, which disappears in hydrochloric acid with effervescence, and which, I believe, is carbonate of lime. The interior of the skull revealed a small mass of black matter, irregular in shape, with a brittle, conchoidal fracture, which was the dried-up and shrunken remains of the brain.

The skull presents the rounded head when viewed from above, and a peculiar straightening and apparent elongation from the parietal eminences down. The air cavities in the temporal bones are large. The frontal sinuses are excessively large, and give rise to prominent supra-orbital ridges. The orbital cavities are rather small. The sutures of the skull are largely obliterated from age, and the thinness of the skull is quite marked.

Examination shows that the nose was large, quite prominent, and inclined to the right side. The cheek bones are high and prominent, and cavities in the bones of the face all large. The lower jaw is very deep, chin prominent, and the angle is very marked.*

*For a detailed account of the teeth, refer to Dr. E. G. Betty's report on the same, published in the *Dental Register*, February, 1884.

The points to which your attention is mainly called in this skull, are: 1. The brachy-cephalic head. 2. The straight and long back of the head. 3. The prominent brow and large nose. 4. The deep lower jaw. 5. The marked facial angle. These are points quite nearly coinciding with the only Mound Builder skull figured in Vol. I., Smithsonian Contributions to Knowledge; also to the skull found in the Grave Creek Mound, and roughly figured by Schoolcraft in Vol. I., Proceed. Am. Ethnological Society, p. 412.

They are points of strong contrast, and great difference from the so-called Madisonville skulls, and suggest a possibility of thus proving a distinction of the Mound Builders into a race by themselves. The fact in itself calls for great care in preserving skulls, which are undoubtedly Mound Builders, by themselves, and carefully distinguishing them from skulls often found in mounds from burials by a later people. It also demands that greater care than that of mere relic plunder is called for in opening and preserving the remains of mounds. Squier and Davis assert that they only found one perfect skull. I feel pretty certain that they did not go as carefully to work to preserve them, or enough of them, for comparison, and the fact that they never reported any attempts at comparison of even different parts of the skull, corroborates my view.

There is nothing beyond the octagonal stone and the great labor of constructing the mound, that is seen in any of the artificial relics, which denotes a state of civilization or condition beyond some tribes of our historic North American Indians. We can conclude, I think, without reasonable doubt, from the age of the trees upon it, that the mound is at least three hundred and fifty years old, and, probably, much older. That would carry us back to the beginning of the sixteenth century, or further—a century before the settling of New York City. It tells us that there existed at the time of its erection an old forest growth, and that our present forest growth is either much older than it indicates in itself, in a direct line, or that it was a later forest growth than the one whose trees were buried to make the vault. An oak tree, one and three-quarters feet in diameter, indicates more than a century's growth. The sea-shell ornaments, from their position, indicates the vanity of the wearer and their probable rarity. They were, no doubt, considered valuable, just as we to-day value rare things with the same barbaric vanity—not because they possess intrinsic value, but because they are rare—and of them we make the same vain display. It is only one of the many relics of barbarism which have come down in our evolution from the barbaric to the civilized state.

*SOME CURIOUS ANIMALS.**

By Edward M. Cooper.

I have thought it might prove interesting to give a brief description of some of the curious animals that existed in past geological ages, but I must deny any claim to originality, and acknowledge that my descriptions are second hand, but derived from sources most authentic; and I assure you that the statements made are not copied from the posters of a traveling menagerie, though some of them may sound sufficiently exaggerated for even *those* reliable essays on natural history. That these wonderful beings have lived at some period of the earth's history, there is no room for doubt, as all the great museums of the world have been enriched with more or less of their remains—even our own Museum containing both casts and actual portions of some of them.

The first one to which I shall call your attention is known as the Megatherium—the word meaning great or huge wild beast—being the name given by Cuvier to a large extinct animal belonging to the Order Edentata. A nearly complete skeleton, found on the bank of the River Luxan, near Buenos Ayres, and sent, in 1789, to the Royal Museum at Madrid, long remained the principal, if not the only, source of information with regard to the species to which it belonged, and furnished the material for many descriptions, notably for that of Cuvier, who determined its affinities with the sloths. In 1832 an important collection of bones of the Megatherium were discovered near the Rio Salado, and were secured for the Museum of the College of Surgeons of England; and these, with another collection found at Luxan in 1837, and now in the British Museum, supplied the materials for the complete description of the skeleton published in 1861 by Prof. Owen, the British geologist. He conclusively proved that the Megatherium was a "ground sloth," and fed on the foliage of trees, uprooting them by its great strength, or pulling down the branches with its formidable forearms, resting on its hind legs and tail as on a tripod. Other skeletons have since been received by several of the continental museums—as Milan and Paris.

In size, the Megatherium exceeded any existing land animal, except the elephant, to which it was inferior only in consequence of the comparative shortness of its limbs, for in length and bulk of body it was its equal, if

* This paper, by Mr. Cooper, was read at the June meeting of the Society, and its publication has been deferred to the present time. It was illustrated by a number of magic-lantern views of the animals spoken of, prepared by Chas M. Woodward.—Note by Editor.

not superior. The full length of a mounted skeleton from the fore part of its head to the end of the tail is eighteen feet, of which the tail occupies five feet. Taking all the various points of its structure together, they clearly indicate affinities both with the existing sloths and with the anteaters; the skull and teeth more resembling those of the former, and the vertebral column and limbs the latter. It is not difficult to infer the food and habits of this enormous creature. That it was a leaf-eater there can be little doubt; but the greater size and more complex structure of its teeth might have enabled it to crush the smaller branches, as well as the leaves and succulent shoots, which form the food of the existing sloth. It is, however, very improbable that it climbed into the branches of the trees, like its diminutive congeners, but it is far more likely that it obtained its subsistence by tearing them down with the great hook-like claws of its powerful prehensile forelimbs, being easily enabled to reach them by raising itself up on the massive tripod formed by the two hind feet, firmly fixed to the ground by the one huge falcate claw, and the stout, muscular tail. The whole conformation of the hinder part of the animal is strongly suggestive of such an action. There can also be but little doubt but that all its movements were as slow and deliberate as those of its modern representative.

Dana, in referring to the Megatherium, says: "It exceeded in size the largest rhinoceros. The length of one of the skeletons is eighteen feet. Its massy limbs were more like columns for support than like organs of motion; the femur was three times as thick as an elephant's; the clumsy tibia and fibila were soldered together; the huge tail was like another hind leg, making a tripod to support the heavy carcass when the animal raised and wielded its great arms, and the hands, terminating the arms, were about a yard long, and ended in huge claws."

The greater portion of the remains of the Megatherium as yet found are from the Post-tertiary geological formations of the Argentine Republic and Paraguay, or the lands forming the basin of the Rio de la Plata. Dr. Leidy has described, from similar formations in Georgia and South Carolina, bones of a closely allied species, but smaller.

The next animal is the Mastodon—the name meaning nipple-tooth—in reference to the conical projections on the molar teeth of some of the species, and given by Cuvier to a genus of extinct elephant-like animals. In size, general form, and principal osteological characters, the Mastodon resembled the elephant. It is by the teeth alone that the two groups are to be distinguished, and so numerous are the modifications of these organs in each, and so insensibly do they pass by a series of gradations into one

another, that the distinction between the two is an arbitrary and artificial one, though convenient and even necessary for descriptive purposes. As in other proboscideans, the teeth of the Mastodon consist only of incisors and molars. The incisors, or tusks, are never more than a single pair in each jaw. In the upper jaw they are always present, and of large size, but apparently never so much curved as in some species of elephants, and they often have longitudinal bands of enamel, more or less spirally disposed, upon their surface, which are not met with in elephants.

Lower incisors, never found in true elephants, are present throughout life in some species of Mastodon, which have the symphysis of the lower jaw greatly elongated to support them. In the common American species —*M. Ohioticus*, Blum.—there were two tusks in the lower jaw in the young of both sexes; these were soon shed in the female, but one of them was retained in the male. In other species no inferior tusks have been found; at all events, in adult life.

Mastodon remains were first discovered at Albany, N. Y., and described by Dr. Mather in the Philosophical Transactions for 1712. The first specimens seen in Europe were found thirty years after by Lonqueil, on the edge of a marsh near the Ohio River, and hence the French called the unknown creature, "The animal of the Ohio." Bones have since been found as high as 70° north, but they mainly frequented a more temperate zone; and we have no evidence that any species was specially fitted like the Mammoth to brave the rigors of an Arctic winter. The remains occur chiefly in the United States, Europe, and India. They must have roamed in considerable numbers among the hills and valleys of the interior states of this country, for the teeth and portions of the bones of many individuals have been found. Several years ago some large skeletons of the Mastodon were dug up in a marsh near Newburgh, N. Y. The late Dr. J. C. Warren, of Boston, obtained one of them, which he set up in his private museum. It is eleven feet high, and seventeen feet long to the base of the tail. The length of the tusks is twelve feet, of which two and one-half feet are inserted in the socket. The estimated height of the animal when living was from twelve to thirteen feet, and the whole length, adding seven feet for the horizontal projection of the tusks, from twenty-four to twenty-five feet. Remains of the undigested food were found between his ribs, showing that he lived in part on spruce and fir trees. The range of the genus Mastodon in time was from the middle of the Miocene period to the end of the Pliocene in the Old World, when he became extinct; but in America several species, especially the best known, owing to the abundance of its remains, which has been variously called *M. Ohioticus*, *M. Ameri-*

canus, and *M. giganteus*, survived quite to a late Pleistocene period. Their remains are met with most abundantly over the *northern* half of the United States, though occurring also in the Carolinas, Mississippi, Arkansas and Texas. The best skeletons have been dug out of marshes, in which the animals had become mired. Three perfect skeletons have been obtained from the fresh water marshes of Orange Co., N. Y.; another from near Cohoes Falls on the Mohawk; another in Indiana; one from a morass in New Jersey, and another on the banks of the Missouri, while *portions* of its remains have been found in this and many other states.

The Glyptodon was the gigantic representative in the Pleistocene times of the armadillos of South America. It was furnished with a huge carapace, or coat of mail, formed of hexagonal plates, united by sutures, and constituting an impenetrable covering for the upper part of the body and the tail—the carapace differs from that of the modern armadillos in having no greaves or joints, for the purpose of contracting or rolling up its body. The head was defended by a tesselated bony casque. The tail possessed an independent dermal sheath, or cuirass, and must have been a very formidable weapon. The bones of the leg and foot were perfectly adapted to bear the steady pressure of this enormous weight. The teeth, numbering eight on each side of each jaw, are sculpterd laterally by two wide and deep channels, which divide the grinding surface into three portions. The generic name was derived from the fluting of the molars. The remains of one of these animals measured from snout to the end of the tail following the curve of the back eleven feet; the tesselated trunk armor being six feet, eight inches in length, and nine feet across, and probably weighing more than a thousand pounds. The Glyptodon does not appear to have emigrated from the central regions of South America, but formed part of a local fauna of the highest interest, which is only faintly represented by the living armadilllos.

The Pterodactyle is one of the most extraordinary of all the creatures yet discovered in the ruins of a primeval world. Collins, in 1784, was the first to investigate the character of this strange animal; he considered it a a fish; Blumenbach decided it was a bird; Sommering, a mammal; Spix, that it was intermediate between monkeys and bats; Macleay, a link between mammals and birds, and Agassiz thinks it a strictly marine reptile. Cuvier in 1800 determined the place and name it now holds.

The *Pterodactylus crassirostris* is distinguished by a very large head, a comparatively short neck, a small trunk, bat-like wings and a tail. It has been estimated that some of these strange monsters, now happily extinct, had an expanse of wing surpassing that of the great albatross, but this

species did not measure over three feet from tip to tip of the wing. Marsh has, however, described one species from the upper Cretaceous of Kansas, which had a spread of wing of twenty-five feet, with jaws and teeth like those of a crocodile, a body like a mammal, and wings like those of a bat. It is difficult to imagine anything more hideous or grotesque than the Pterodactyle. By the excessive elongation of the little fingers of the forefeet, support was afforded to a membrane, which extended to the tail, and made a wing for flying—the remaining fingers being short and furnished with claws; the long slender jaws were set with a number of teeth in sockets; the bones were hollow and light as in birds. They had the habits of bats and wings of a similar character, and yet are properly classed with the reptiles.

The Dinotherium was a huge pachyderm, which, though its teeth were discovered more than a century ago, has not yet found a resting place in the classification of animals. Cuvier called it a gigantic tapir; DeBlainville and Pictet considered it an aquatic herbivore, resembling the Dugong; Kaup regards it as intermediate between the Tapir and Mastodon, and truly terrestial; while Owen says it is a hoofed quadruped of probably aquatic habits. One of the singular features in connection with this animal is the enormous down-curving tusks, which were probably used in tearing up the roots of water plants needed for food—though Ansted thought they might also be used as anchors to attach the animal at night to the bank of the river or lake in which it dwelt.

The Plesiosauris was first discovered in 1823 by Coneybeare and DeLa-Beche. Cuvier thought "its structure the most singular, and its characters the most anomalous that has been found amid the ruins of a former world." To the head of a lizard (wrote Buckland) it united the teeth of a crocodile; a neck of enormous length, (consisting of from twenty to forty vertebræ) resembling the body of a serpent; a trunk and tale having the proportions of an ordinary quadruped, and the paddles of a whale.

The Hesperornis was a water bird, with powerful swimming legs and feet, peculiarly adapted to rapid motion through the water. The length from bill to toe was about six feet. The wings were small and rudimentary, and could have been of no service for flight. Its teeth indicate carnivorous habits, and its food was probably fishes.

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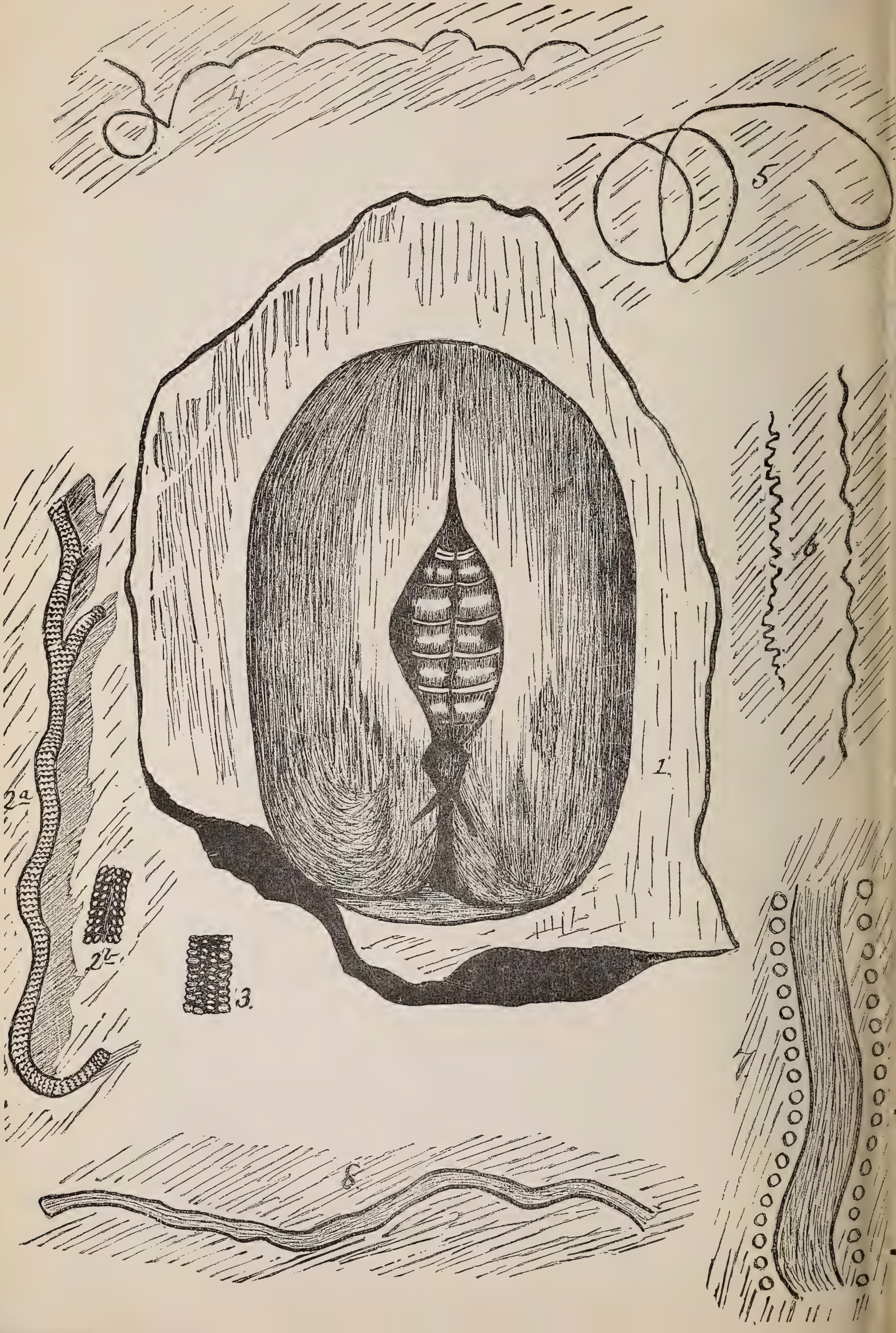
INDEX TO VOL. VII.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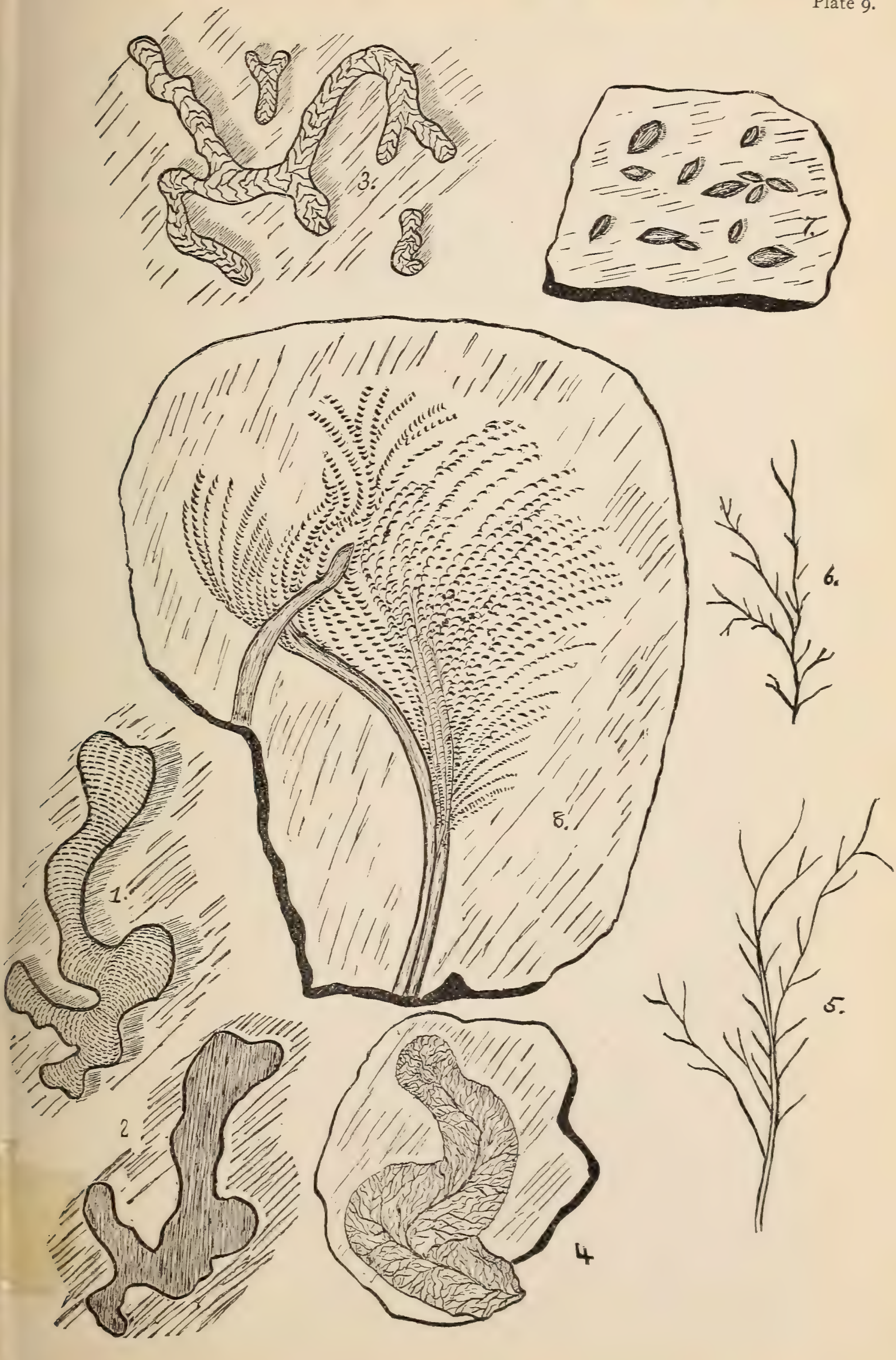
Description of Plate VIII.

Description of Plate IX.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Description of Plate X.

T.—Hieroglyphic of the year 13 Acatl (twenty-sixth year of cycle).
A.— " " day 4 Ocelotl (22d of May) in first year of cycle.
B.— " " " 4 Ehecatl.
C.— " " " 4 Quiahuitl (26th of July) in first year of cycle.
D.— " " " 4 Atl.
H.— " " " 10 Ollin (22d of September) in first year of cycle.
M.— " " " 2 Ozomatli (22d of June) } in twenty-sixth year of
N.— " " " 1 Quiahuitl (22d of March) } cycle.
E, F.— " of two astrologers.
R.—The right rays of the sun.
L.—Subdivision of the sun.
P, P, Q, Q }
S, Y, X, Z } Holes in the edge vertical to the surface of the stone.
I.—Triangle, summit of which indicates the first and last day of the month.

The names of the days, CIPACTLI, EHECATL, CALLI, etc., have been substituted for their hieroglyphics.

THE CALENDAR STONE.

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CONTENTS.—VOL. VIII.

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JOSEPH F. JAMES.

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TABLE OF CONTENTS.

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PROCEEDINGS OF THE SOCIETY.

Meeting of *January* 6, 1885.

As there was not a quorum present, no business was transacted.

An informal discussion took place on a short paper, read by Prof. Joseph F. James, on "Evidences of Beaches in the Cincinnati Group," the author holding that the tracks and burrows found in the rocks, were evidences of the presence of beaches at the time the rocks of the Cincinnati Group were deposited.

The donations for the month were as follows: From Lieut. Thos. L. Casey, "Revision of the Stenini of America North of Mexico;" from G. H. Curtis, Ten Microscopic Slides of Hairs and Scales; from Kentucky Geological Survey, Four Volumes of Reports; from Chief Signal Officer, "Monthly Weather Review" for October, 1884; from Bureau ot Ethnology, "Second Annual Report, for 1880–81"; from Nelson Perry, Specimen of Wire Silver; from John G. Morgan, Gold and Silver Ores from Colorado; from Ohio State Librarian, Vol. V., Geological Survey of Ohio; from T. H. Wise, "Young Mineralogist," Vol. I., No. 6; from E. S. Clark, M. D., Thirty-nine Species of Fossils, from Louisville and Clark Co., Ind.; from Jos. F. James, Eight Species of Fossils, from Louisville; from C. R. Brown, Specimens of Human Bones, from a gravel deposit: bear's tooth, flint celt, and Mastodon bone and part of tusk.

The fourth course of Free Popular Scientific Lectures, given under the auspices of the Society, began on January 2d. The first of the series was by Prof. Wm. L. Dudley, on "Water Crystallization." The lecturer began by explaining the process of the freezing of water. This takes place when the temperature falls to 32°; and,

contrary to the general rule of substances, water expands instead of contracting when it is cooled. If a goblet of water be placed under certain conditions, it will not freeze, even if cooled several degrees before freezing point. But if agitated ever so slightly, by jarring, for example, congelation immediately ensues. Snowflakes are always six-sided, or have six rays. The expansive power of water when freezing, was shown by experiments made at Quebec. An iron bombshell was filled with water, and a peg driven into the hole. After a few hours exposure to a temperature of 25° below zero, it was found that the peg had been driven out of the hole to a distance of one hundred feet, and a core of ice six inches long was shot out of the aperture. The method of making artificial ice was explained, as was also regelation, or the freezing of two pieces of ice when brought into contact. The pasticity of ice and the movements and appearance of glaciers was spoken of. The lecture was illustrated by magic lantern views.

On January 9th, Dr. W. A. Dun gave a talk upon some magic lantern pictures. He prefaced the exhibition by remarks upon the necessity of a Natural History Museum, and showed what a chance there was for some of the rich men of the city to rise and put the Museum of this Society on a firmer basis, and thus erect for himself a durable and magnificent monument. The views shown were of the Zuni Indians, and scenes from various parts of this country and Europe.

On January 16th, Prof. J. W. Hall, Jr., lectured on "Gems and Minerals." He explained many of the popular superstitions concerning minerals. The ancients believed them to be alive, because, said they, they become ill, decay and die. The opal was formerly regarded as a lucky stone, preserving the owner and wearer from many ills. Now it is regarded as a gem of ill-omen, and even people of intelligence refuse to wear opals because of the fear of bringing misfortune upon themselves. The history of the diamond was fully entered on. It is, like coal, pure carbon, only having undergone some peculiar treatment which makes it what it is. The etymology of "diamond," the manner of finding the stones, and a history of the most celebrated gems were given. All the more noted diamonds have had eventful histories, in which

murder and intrigue have played a very prominent part. Some were found by slaves and sold for small sums, changing hands many times and increasing in value each time. The Grand Mogul, belonging to Russia, is valued at $1,500,000, and the Koh-i-noor of England, is worth $800,000.

On January 23d, Prof. Joseph F. James, lectured on "The Ancient Vegetation of the Earth." He spoke of the difficulties of preserving Algæ from decay, and said, that though no doubt the seas of early geological ages swarmed with Algæ, yet it is doubtful if many have been preserved. The peculiarities of the flora of the Carboniferous Period, and the manner of formation of coal were described. The flora of later geological periods, Cretaceous and Tertiary, was spoken of, this being the forerunner of the present flora of the earth. A review showed that there was a general advance in structure of plants from the earliest to the latest geological periods.

On January 30th, Col. James W. Abert lectured on "Nature in Art." He defined Nature as concerned with material things, animate and inanimate, and Art as man's expression of Nature. Artists conventionalize from Nature, changing her forms to suit their purposes, especially in decoration. In painting landscapes, they select the agreeable and pleasing, but reject the inharmonious. The number of wave lengths in different colors varies. There are 400 trillions in red, and 720 trillions in violet. The sound waves on a seven octave piano vary from 40 to 4,000. The mixing of colors is a great art, as is also the massing of colors in pictures to give the best effects.

MEETING OF *February* 3, 1885.

Vice-President Skinner in the chair. Sixteen persons present. The following papers were presented and referred to the Publishing Committee :

THE ANCIENT AZTEC OR MEXICAN METHOD OF COMPUTING TIME,

As shown by the Description, by ANTONIO LEON Y GAMA, of the Celebrated *Calendar Stone,* found in the Grand Plaza of the City of Mexico, in 1790—
Translated from the Spanish, by

COL. JAMES W. ABERT.

PRELIMINARY DISCOURSE.

I have always been possessed with the thought that in the Grand Plaza of this city and at the gate of Santiago Tlatelolco there would be found many precious monuments of Mexican antiquity, because the first place included the site of the grand Temple of Mexico, which was composed of seventy-eight edifices, including small temples, chapels and the dwellings of priests and ministers. There were kept, not only the numerous false gods, which they worshiped in blind idolatry (which were of hard stone, and of excessive magnitude and weight, and, for that reason, difficult to carry off), but also many instruments which they used in their arts and duties; also, historical and chronological records, which were preserved, engraved in great stones by these same priests, whose charge was the care of the memorials of the deeds of their ancestors and of everything else connected with their political and religious government; in the second place, Tlatelolco was the last stronghold, where the Indians retreated and maintained themselves until the day of the capture of their city. It seemed most probable that there they would have brought their Penates, or less weighty idols, as well as all materials they had fabricated, which they regarded as most precious, and which they kept in their own dwellings, as well as all the jewelry and treasures which they possessed, and other valuables which served to adorn their idols; and all the riches that the Spaniards lost the night they were driven out of Mexico, which riches they could not afterward recover, notwithstanding the great diligence and solicitude they exerted, even in searching the whole lake, into which the Indians said they had thrown them. It was then most probable that all of their things, or at least the greater part of them, might be buried in the earth

at Tlatelolco. If one should make excavations, as it was proposed to do in Italy, in order to find statues and fragments, which would bring back the memoirs of ancient Rome, and which was actually done in Spain at the villa of Rielves, three leagues distant from Toledo, where they discovered various ancient pavements, how many monuments might not we discover of the ancient Indians? How many books and pictures which the priests had concealed, and especially the *Teoamoxli*, in which, in their native characters, they had written their origin; the progressive moves of their nation from their exit from Aztlan until they came to populate the lands of Anahuac; the rites and ceremonies of their religion; the fundamental principles of their chronology and astronomy, etc? And what treasures might not thus be revealed?

Thus it actually happened, for in a few days we obtained revelations, which told us what the Indians were in the time of their nationality, by means of the discovery of two precious monuments, which demonstrated their culture and instruction in the sciences and arts. From these it is evident how much a particular find reveals, and how it can be an original and instructive document which displays a great deal of history and chronology, and also the exact manner in which the Mexicans measured time, for the celebration of their feasts and for their political history; for most of their histories had perished in the flames, or were lost by the inability to interpret what their picture-writing signified. What a deplorable loss those men of taste have suffered, who devote themselves to the study of the antiquarian literature of these nations!

On the occasion when the Government ordered that the Grand Plaza should be paved and leveled, and they made excavations in which to conduct the water through subterranean channels; and while busy excavating for this object, about the end of the month of August, in the year 1790, they encountered, but a short distance below the surface of the earth, a statue curiously wrought out of stone, of extraordinary magnitude, which represented one of the idols that the Indians adored in the time of their nationality. But a few months passed when they found the other stone, much larger than the antecedent one, only a short distance from it, and almost touching the surface of the ground, so placed that upon the upper

side, as it was found, there was no carving; but the under side, which was hidden in the ground, displayed numerous carvings. Both stones were exhumed. The first was taken to the Royal University; the second remained for some time where it was found, but was placed in a proper vertical position, so that one could note readily all that was engraved upon it. As soon as I saw it I was filled with delight at having found in it a faithful testimonial, which proved what I had written with the cost of so much labor and study in regard to the system of Mexican calendars, and against the false hypotheses with which some have confused and disfigured their works while pretending to explain the history of the Indians, which things I have demonstrated in my Indian chronology, and have pointed out the most notable errors of former writers in this work.

As I had been engaged for some time in making examinations of the manuscripts of the Indians in the Mexican idiom, as well as of the narratives of our own Spanish histories, together with the picture-writings in my possession, cited in that work, it was easy for me to comprehend what was the signification of the carvings and figures engraved upon this second stone, bringing to my mind by its means all the images which we find so confused, dispersed and mutilated, in the writings of the Indians themselves, and in no manner explained by Spanish authors. And although I succeeded at the cost of great labor in comprehending others which had not previously been brought to my notice, still there remain some of their figures, whose hieroglyphics involve too many allegorical significations to be entirely interpreted.

On account of its being exposed to the public and without any care, it was difficult to prevent puerile and rustic people from mutilating and maltreating it, and injuring the carvings with stones and other instruments much more than it had suffered up to the time of raising it, so that before they should injure it more we could dispose of it in a different manner than at first intended. I caused to be made, under my supervision, an exact copy of it, to be kept in my possession as an original monument of antiquity, and I drew up a few annotations in regard to what the carvings meant. But having communicated them to several persons, curious in such

matters, they insisted that I ought to publish my explanation, and knowing that if I omitted to do so, or to publish the copy (if by any casualty it might be destroyed, or if it should suffer the destiny once intended for it, the work would perish, and there would remain no copy, or notice, of what this great monument contained), the ancient history of Mexico would suffer the same misfortunes which it had suffered for so many years by the loss of former records, which had been cast into the fire because no one had any appreciation for them, or had been purposely concealed in the earth.

I determined to publish the description of both stones, in order to contribute information to antiquarian literature, which is so much encouraged in other countries, and that our Catholic monarch, Senor Don Carlos III. (whom God preserve!), being King of Naples, promoted by means of the celebrated museum which, with the cost of enormous sums of money, he caused to be founded at Portici, from the excavations he caused to be made in discovering the ancient cities of Herculaneum and Pompeii, buried for so many ages under the ashes, stones and lavas of the eruptions of Vesuvius.

I was impelled also to manifest to the literary world the great knowledge that the Indians of America possessed in arts and sciences in the time of their nationality, in order that it should know how falsely they were caluminated by unreasonable or senseless people, enemies of the Spaniards, with the purpose of sullying the glorious exploits achieved in the conquest of these regions. By the narrative of this paper and by the figures it presents to view, will be manifested the dexterity of the artificers who made these works, since they had knowledge neither of iron nor steel, but they engraved with such perfection in hard stones, statues which represented their intended semblances, and made other works in architecture, using in place of tempered chisels and sharpened picks stones that were more solid and harder.

In the second stone were manifested various departments of the science of mathematics, which they knew to perfection. Its volume and weight demonstrated their knowledge of mechanics and machines, without the fundamental principles of which they could

not cut it, or transport it from the place of quarrying it to where it was located. By the perfection with which they formed the circles, by the concentric arrangement maintained between them, by the exact division of the parts (of the circumference), by the direction of the right lines to the center, and by other particulars which are not used by those who are ignorant of geometry, is manifested the clear knowledge of this science possessed by the Mexicans.

In regard to astronomy and chronology, similar interpretations derived from this stone, which we are going to explain, will demonstrate how familiar they were with observations on the sun and the stars for the measurement of time and its distribution into periods, which had a certain analogy with the movements of the moon, of which they found a "solar-lunar" year, which served to regulate their festivals on certain determined days, so that they could not vary from the times prescribed for their rites more than thirteen days in the prolonged interval of fifty-two years, at the end of which cycle they reformed their civil year.

The various stories that our old Spanish historians narrated about the magnitude and the material of which the Indians fabricated their false gods, and the prejudices which our first religious men conceived when preaching the Holy Evangelist, in regard to what they saw engraved on stones, or depicted on cloth or paper, as an object of idolatry, occasioned the confusion in which all found themselves, without knowing how to discriminate which were the symbols which belonged purely to the worship of their gods, and which appertained to their histories.

The latter were regularly engraved upon large stones, and upon the portals of the palaces of their chiefs they depicted the exploits of their ancestors. There was no city or town which did not contain engraved upon the stones of its walls, or on the rocks of its mountains, the year of its foundation, the origin of its name, who were the founders, and the progress made in it—all represented in symbols and characters that none understood but the Indians themselves, without whose aid it was not easy for the Spaniards to comprehend them. As the Spaniards were ignorant of what these figures signified, they demolished many objects belonging to his-

tory, believing them objects of superstitious rites. The Indians, some fearful that they should be accused of returning to idolatry, others malicious, concealed the truth of their signification, and told fables and exaggerations, not only to the Spaniards, but also to those of their own race who endeavored to inform themselves, as is narrated by Don Fernando de Alva Ixtlilxochitl at the end of the "Complete relation of all things which have happened in New Spain," which refers to their political and historical events, but they all maintain silence in that which regards their ancient religion. There is no one who makes mention in his writings of all their gods, of the forms in which they figured, of the various attributes which they possessed, of their transformations, and the offices with which they distinguished them, and of the mode of worship rendered them, and although one or another gave a slight idea of them, and some curates and monks knew much, still, that which they wrote was so little and so obscure, that no one can form a complete idea of their mythology; notwithstanding, by combining the manuscripts of anonymous authors, and what was subsequently promulgated by curates and monks, one can obtain a good deal, but with the cost of great labors. Those of the monuments, whose description we propose to give, have the good fortune of being verified in the express relations and authority of persons of the most distinguished character, as well as regards their literature, as in the order of events, to which we are obliged to give the greater credit on account of their high antiquity, (but it is no little matter, in things so obscure as the history of the Indians, to find authorities printed which confirm what one has obtained with so much labor). The manuscript narratives in the Mexican language, of which I have made use, are most reliable and truthful. I do not find in them the contradiction I find in others, neither in the substance nor in the manner of relating events, for which reason they always have their highest value with the Spanish savans who possess them. But in some the details are so meager that you learn but little or nothing in regard to the Indians, relating to their mythology, chronology and astronomy.

From these and other writings, and from ancient picturegraphs, I have deduced the signification of the two stones; but as it requires

for their proper intelligence, that one should know the manner in which the Mexicans divided their time, and their calendars and their "Tonalamatl," and especially in order to be able to comprehend perfectly the interpretation of the second stone, we will divide our explanation into four sections or parts. The first will contain the general method of observing and distributing time into fixed periods of cycles, years, months and days, and their aliquot parts, in all that regards their weeks, or rather trecenas, of which they composed their Tonalamatl, in which you will find an account of the first of the two stones we have found (*i. e.* the Statue). The second part will be the explanation of the idol stone (*i. e.* the Statue). In the third will be contained in brief, the computation by which they governed themselves, depending on the movement of the sun and moon, for the celebration of their festivals, for their commercial affairs, and for other uses, both civil and political, and we will establish the veritable calendars, refuting as false, erroneous, and absurd all other systems which certain authors have invented, as being entirely opposed to what the relation of the Indians themselves have established, and to the naturalness and invariable method which they observed in all matters relating to their government. We will harmonize the two kinds of calendars with themselves and with ours. We will establish the commencement of their year, with other details relating to their chronology—and finally, the fourth part will be an exact account of the carvings and symbols contained on the second stone, and of the chief purposes for which the Mexicans made use of it. But, since after the conclusion of this work, there have appeared other notices and circumstances which have more interested the curiosity of the public; in order not to deprive the people of them—it seemed to us most proper to insert them in the following

ADDENDA.

When it was announced in the *Gazeta De Mexico* of the 16th of August, 1791, that this book was concluded, inviting persons who were interested in such matters to subscribe, I was then ignorant of the important proceedings taken by His Excellency Senor Virey, Count of Rivilla Gigedo, and by the Senor Superintendent, Don

Bernardo Bonavia y Zapata, conducive to the perpetual preservation of these images, and preservation of memorials in regard to them, as precious monuments, which display the knowledge possessed by the Indian nation in the times anterior to their conquest, about which matters they took no care in subsequent times, for it was determined then to hide from the Indians all that might tend to remind them of their passed idolatries, together with what remained of the ancient history of the nation, which was wholly, or at least in part, deprived of original documents that showed this people to be one of the most civilized and statesman-like nations in the new world, and defended them against the calumnies with which foreign nations have always stigmatized them.

The same day the notice was published, the Mayor sent for me, influenced by his great benignity, and communicated to me not only the measures he had taken, impelled by his zeal, solicitude and energy, which he displayed in matters that were committed to his care ; but also informed me of the legal steps he had taken upon the event of the finding of those stones ; in order that the public should know all about them, as to the days, hours and places where they were found. The effect upon the antiquarian literature, and the desire to illustrate the history of Mexico, is sufficiently manifested by the official letter with which he imparted to His Excellency Senor Virey, the notice of this find ; insisting, that at once measures should be taken in order that the preservation and security of the first statue should be maintained—which measure His Excellency approved, in the same terms as proposed in the official expression, which is thus stated in said letter :

"Most Excellent Sir : In the excavations which are being made in the Plaza of the Palace, for the construction of the water pipes—as you know, there was found a figure in stone of considerable size, which is acknowledged to be anterior to the conquest. I consider it worthy to be preserved, on account of its antiquity and on account of the scarcity of the monuments which remain of those times, and of the matters which contribute to illustrate them ; being persuaded, that with this object in view, I could not place it in better hands than those of the Royal and Pontifical University. It appears to me most suitable to place it there, not doubting that it will

be received with delight, retaining for myself the right, if you think it proper, of causing it to be measured, weighed, drawn and engraved, in order that these details should be prepared to accompany the informations which the said college may indicate or discover, in regard to its origin.

"God keep Your Excellency for many years.

"Mexico, 5th Sept., 1790."

To this official document, Senor Virey, on the following day, the 6th, manifested his concurrence, as the following expressions denote:

"I consent most gladly, that you may transport to the Royal and Pontifical University, the stone-statue, found in making excavations at the Plaza of this Palace, and that it shall be placed in a position in that edifice, which is considered to be most suitable. You yourself (as you proposed) taking charge of the duties of causing it to be measured, weighed, drawn and engraved, in order to publish these matters, in company with the information which that illustrious college may possess, or may be able to point out, in regard to its origin."

Subsequently the Senor Rector made this same solicitation, and by another note of the same September 22d, His Excellency advised the Senor Superintendent, that he should impart to the said Rector the authenticated notice of the find; which was done in the following official document.

"In compliance with that which His Excellency, Senor Virey, was pleased to inform me, in the official note of the 22d of the last month, I transmit to you the testimony which affirms the finding of the figure of stone, in appearance, heathen, encountered in the excavations of the Grand Plaza, which, as soon as you can arrange it, will be transported to the Royal University, for the purpose of preserving it, and so that with the aid of the informations and documents in the library, one can form an appropriate dissertation. It being my duty when it is placed there, to have it to be weighed, measured and engraved, in order that, with the accounts, may be given to the public at the same time, the drawing, the weight and the dimensions. God keep you, etc.

"Mexico, 29th Oct., 1790."

In consideration of this note, it was actually transported to the Royal University, where it is now located in one of the angles of the portico; but the dimensions, weight, drawings and engraving which the Superintendent offered to make, were not made, on account of the numerous important duties which occupied his first attention, and perhaps he delayed to make them, because he had received notice that I began the labors of giving its description to the public.

By legal proceedings it is evident, that on the 13th day of August, 1790, a day memorable for being the same on which the King of Spain took possession of the city in the year 1521 (although two witnesses state ambiguously, that it was the 14th), being engaged in excavating the ditch for the stonework through which the water should flow, there was found, close to the little chests which are called after Saint Joseph, at the distance of 5 varas north of the acequia, and 37 to the west of the Royal Palace, the stone statue; the head of which was buried at the depth of one vara and a third, and the other extremity, or foot, at little less than one vara. On the 4th of September, at midnight, it was suspended and placed in a vertical position, by means of a tackle with double pulleys; and at the same hour on the night of the 25th, it was drawn away from that place, and rested in front of the second door of the Royal Palace, whence it was afterward transported to the Royal University.

But a short time had passed after its being moved, when, on the occasion of the repaving, on account of the sinking of the ancient level of the Plaza, on the 17th of December of the same year, 1790, was discovered, at only one yard's depth, and at a distance of 80 to the west of the same second door of of the Royal Palace, and 37 to the north of the "Portal of Flowers," the second stone; its posterior surface uppermost, as is testified by official documents of the 12th of February, 1791, transmitted to the Senor Superintendent, by one of the Grand Masters of N. C. D., Joseph Damian Ortiz, communicating the notice of the find.

This second stone, which is the largest and most instructive, he begged of His Excellency Señor Virey, for the Seniores, Doctor Joseph Uribe and Doctor Don Juan Joseph Gamboa, Commission-

ers of the Building of the Holy Cathedral Church ; and although there is no evidence of having perfected this request by letter, or in any other legal manner, or by any decree of donation, the delivery was made on the verbal order of His Excellency, to the said Seniores, Commissioners, according to what has been communicated to me by the Superintendent, under the condition that it should be set up in a public place, where it should be always preserved as a valuable monument of Indian antiquity.

But not only were there found these two stones in the space which was repaved of the Grand Plaza, but other ancient monuments were discovered, which were not made known to the public like the preceding ones. Nothing was known about them until this same Superintendent communicated to me the notice, giving an order to the Lieutenant Colonel of Engineers, Don Miguel Costanzo, that he should inform me of all that it contained, which, in fact, he did, in terms which were put afterward in a letter. This new discovery confirmed all that I had predicted about the many antiquities that would be found in the Grand Plaza. Since if thus, in a short interval, and at but slight depth, one find such valuable relics of remote Mexican antiquity, we may readily believe that, in places not repaved, and in deeper excavations, others will be discovered which will throw new revelations on their history. The discovery was a sepulchre, that contained the bones of some animal that no one knew, notwithstanding the preservation of the head, the teeth, and the fangs, characteristics which generally distinguish the species of quadrupeds. With them were found various porringers, and other articles of clay, well manufactured; several large bells of metal, and other things of like nature. I was not able to see any of them, because they were in the possession of Captain Don Antonio Pineda, who actually resides in the City of Guanajuato.

I would hardly dare to say anything in regard to them, if it were not from conclusions deduced from what I was informed by the said Lieutenant Colonel of Engineers, and from the details he gave me, which are as follows:—

A Peon, named Juan de Dios Morales, in the month of February of this year, 1791, near the middle of the square recently con-

structed in front of the Royal Palace, inclosed with posts and chains, discovered a sepulchre of from one to two varas in length, and one vara in width, formed of slabs of "tezontle,"* very well dressed; the interior was filled with white sand, very fine, and here were found the whole bones of some unknown animal, together with various fragments of porringers of clay, similar to those from Quantitlan, but of much better manufacture, which contained some bells of copper, well cast, in the form of pears, and other trinkets of the same metal. The animal, as some inferred, from the large fangs which issued from both jaws, may have been a coyote (wolf or dog) of extraordinary magnitude; but it is uncertain if this conjecture is well founded.

Combined with the finding of this animal in a sepulchre so well constructed, in a place that was included in the limits of the grand temple, with the bells, trinkets, and many other things which were found interred together with it, taken with what has been related by Dr. Hernandez and Padre Torquemada in describing the temples, chapels, and other structures included in the grand temple, we conclude that this animal was one of the gods which the Mexicans adored under the name of "Chantico," which, according to the said Torquemada, signifies "the wolf's head." Having questioned the said Colonel as to its resemblance to a wolf, he answered that the formation of the fangs and their arrangement were similar to those of that animal. We know that among the multitude of absurd gods that the Mexicans worshiped there were several animals; as the tiger, with the name of *Tlatoca-ocelotl;* the eagle, with the appearance of the peacock, called *Quetzatme-xolo quaulitli;* the serpent, or *cilma cohuatl,* and others.

This wolf-god had a particular temple in the grand square of Mexico, with the name of *Tetlanman.* In it they celebrated their rites, with sacrifices of captives, during the rule of the sign of *Ce Xochitl.*

It had for associate another—a goddess—named *Cohua Xohotl,* according to Torquemada, and *Quaxolotl,* according to Hernandez, in whose honor, also, they celebrated the festival. Various priests were destined to the service of the god "Chantico." They had

*Stone.

their dwelling separate—a species of convent, with the name of *Tetlacmancal Mecac*, all of which the authors quoted assert, although Hernandez equivocally names the goddess *Chantico*. Therefore there can scarce be any doubt that the bones that were discovered were those of this animal, to which, on account of some special attribute, of which we are ignorant, they offered up adoration, and classed it among the number of their gods.

I.

Methods of dividing time used by the Mexicans and other nations of New Spain.

1. Since the Toltec nation (from whom the Mexicans are descended) in their ancient country, called *Huehuetlapallan*, counted their year and reformed their calendar, the division of time into constant and uniform periods remained established without any substantial variation, although in the manner of reckoning them there may be some differences, according as circumstances combined, relative to the migrations, the rites, the religious and political acts of the nations, which, in successive times, came to populate the lands of *Anahuac*. The Mexicans, who were the last who happened to establish themselves, did not forget the customs they had received from their ancestors, which were observed in *Aztlan*, their country, but having emigrated from it, they were forced to vary their reckoning for reasons which we have already stated, but they always maintained their dates constant, varying only their cycle.

2. They divided the natural day into four principal parts, which were, from the rising of the sun until midday, from midday until sunset, from that time until midnight, from that time until the next sunrise. Hence they called the beginning of the day *Yquiza Tonatiuh;* the middle of the day, *Nepantla Tonatiuh;* the sunset, *Onaqui Tonatiuh*, and midnight, *Tohual Nepantla;* subdividing, also, each of these intervals into two parts, which correspond approximately to 9 in the morning, 3 in the afternoon, 9 at night, and 3 before dawn, when they supposed the sun to be equidistant from the points of rising and midday, and from midday to setting, and from this to midnight, and from this to the rising of the sun

on the following day. These middle intervals had no particular name, neither did the hours of the day, and they designated only the position the sun occupied in the heavens, when wishing to point out the hour, saying, "*Iz Teotl,*" "there is the day," or the sun.

The hours of the night they regulated by means of the stars. These duties belonged to the ministers of the temple, who wore, destined for this duty, certain instruments, like speaking trumpets, with which they announced to the people the hours at which the people should assemble for the sacrifices, and other ridiculous ceremonials belonging to their nocturnal festivals.

3. Each one of their months was composed of the aggregation of twenty natural days, which they divided into four "Quindies." On each division they celebrated "fairs" (or markets), which they called Tianquiztli. Of eighteen of their months they formed the common year, or the 360 useful days, to which they added five days at the end of the last month, and they named them *Nemontemi,* which is equivalent to calling them *vain* or *useless* days, for on these they neither worked nor engaged in any business, remaining constantly unoccupied and in anxious fear that some calamity would befall them; believing, in the madness of their superstitions, that, on the last of those five days, the world would be destroyed.

They reckoned this time as unfortunate to those creatures that were born on these "Quindies," and they always designated them as unfortunates by the names they gave them, since to males they gave the name of "*Nemo quichtli,*" and to females, "*Neo cihuatl,*" which signified unhappy man or woman.

Notwithstanding these five days were accounted as useless for every species of labor or political occupation, they held them in great esteem, adding them to form the complement of their civil year of 365 days, in the same way as the Egyptians, who, in order to adjust their year to an equal number of days, added to the end of their last month other five days which they called *Epagomenai.*

4. They represented the eighteen months of the year in the form of a circle, with the same number of divisions, or squares, in which they carved the respective symbols by which they designated each one of the said months. They called this kind of wheel *Xiuhtlapohualli,* or the sun. In the same circular form they represented

their cycle, which was a period of 52 years, which they named *Xiuhmolpilli*, and signified the binding together of the years. Sometimes they represented two consecutive circles; the one contained the eighteen months; the other, which circumscribed it, was the cycle of the 52 years. They surrounded this cycle of years with a serpent, that had four coils or inflections, one in each quadrant of the circle, commencing at the head, in the mouth of which the extremity of the last inflection entered, denoting in this manner that, where one cycle terminated, there another commenced. In this form was the engraving that was drawn by Dr. Gemelli Carreri in his book, or circle, of the world. Two of these periods composed the grand cycle, or century, of 104 years, which they called *Ce huehuetiliztli*, that is, an "era," or an "age;" but this age had no particular symbol in their picturegraphs, and they always divided it into two periods, or cycles, of 52 years. Each one of these half centuries was divided into four tri-decades of 13 years, which were signified by each inflection of the circumscribing serpent.

5. With four symbols only, that were represented thirteen times, they represented completely their cycle of years, or *Xiuhmolpilli*. Their symbols were: Tecpatl, flint; Calli, house; Tochtli, rabbit; and Acatl, cane. But they were so disposed that, although there were but four symbols distinguished by a particular representative, yet no one would confuse one year with another in the cycle of 52 years, or *Xiuhmolpilli*, for they distinguished them by numerical characters, which corresponded to each one of the symbols in the order as they reckoned them, although in the whole reckoning the same number was repeated four times.

For example: They commenced to count the Mexican cycle, or *Xiuhmolpilli*, by the symbol Tochtli, and with the number 1; that which followed, Acatl, with the number two; afterward, Tecpatl, with 3; and then, Calli, with 4; and continuing to use the same four symbols in this order will give to Tochtli the number 5, to Acatl 6, to Tecpatl 7, and to Calli 8; and thus the reckoning is carried on through the cycle (or half a century), 52 years, but without counting them all progressively from one to fifty-two, but interrupting the count when one arrived at thirteen; and in this

manner they divided the circle, or wheel of the cycle, into four tri-decades of years, whose figures and symbols they represented in an inverse order to that which we practice in our writings—commencing theirs on the right hand, and proceeding toward the left, a fashion which they practice in all their picturegraphs. To each of these indictions, or tri-decades of years, they gave the name *Tlalpilli.*

6. Although this method of counting the years by periods of fifty-two was general in all the principalities and provinces of the kingdom of Mexico, and the symbols and order of placing them was also the same, all did not commence to count their cycle by the same year. The Toltecs began it with Tecpatl, the Teotihuacans with Calli, the Mexicans with Tochtli, and the Tezcocomos with Acatl; hence, there was a difference among these nations as to the time when they began the correction, and equalized the civil year with the solar tropical, of which we will speak hereafter; consequently, there not being the same date on which all bound up their years, there was a difference of several days in the reckoning of some nations when compared with others; but all knew well what was the difference, and they took account of it in their commercial treaties.

7. The Mexican cycle (or half century) is reckoned in this manner:

Mexican Cycle of Fifty-two Years.

1 Tlalpilli. or Indiction.		Year.	2 Tlalpilli. or Indiction.		Year.	3 Tlalpilli. or Indiction.		Year.	4 Tlalpilli. or Indiction.		Year.
(1)	Tochtli,	1	1	Acatl,	14	1	Tecpatl,	27	1	Calli,	40
2	Acatl,	2	2	Tecpatl,	15	2	Calli,	28	(2)	Tochtli,	41
3	Tecpatl,	3	3	Calli,	16	(3)	Tochtli,	29	3	Acatl,	42
4	Calli,	4	(4)	Tochtli,	17	4	Acatl,	30	4	Tecpatl,	43
5	Tochtli,	5	5	Acatl,	18	5	Tecpatl,	31	5	Calli,	44
6	Acatl,	6	6	Tecpatl,	19	6	Calli,	32	6	Tochtli,	45
7	Tecpatl,	7	7	Calli,	20	7	Tochtli,	33	7	Acatl,	46
8	Calli,	8	8	Tochtli,	21	8	Acatl,	34	8	Tecpatl,	47
9	Tochtli,	9	9	Acatl,	22	9	Tecpatl,	35	9	Calli,	48
10	Acatl,	10	10	Tecpatl,	23	10	Calli,	36	10	Tochtli,	49
11	Tecpatl,	11	11	Calli,	24	11	Tochtli,	37	11	Acatl,	50
12	Calli,	12	12	Tochtli,	25	12	Acatl,	38	12	Tecpatl,	51
13	Tochtli,	13	13	Acatl,	26	13	Tecpatl,	39	13	Calli,	52

So that in the first indiction, the symbol Tochtli is found to be accompanied with the numbers 1, 5, 9 and 13; in the second,

with 4, 8 and 12; in the third, with 3, 7 and 11, and in the fourth, with 2, 6 and 10.

The same thing happens with the rest of the symbols that begin the other three indictions; hence, we deduce the following rules: Each indiction finishes with the same symbol with which it begins; and it occurs four times in the first and three times in the others. Always when the numerical characters accompanying a symbol are 1, 5, 9 and 13, the period will be the first of the same indiction as the symbol; but it will be otherwise if the numbers are different, which, compared with those that are arranged in our table, will make known what indiction it must be. And thus it will be easy to ascertain whatever year is referred to separately, and to what indiction it belongs, and, consequently, how many have elapsed since the commencement of the Mexican cycle.

Although the Mexicans commenced their cycle with the symbol "ce Tochtli"* (first rabbit), they did not prefer it, but the following year, "ome Acatl" (second cane), upon which they held the grand festival of fire, which they celebrated in honor of their secular gods, and it endured for thirteen days, as we have previously stated. In all their picturegraphs we see the hieroglyphic of the "binding of the cycle," with the symbol "ome Acatl;" and in all their annals and manuscript documents their authors expressly relate that on this year they bound their cycles and rekindled the sacred fire. A long time elapsed before I could ascertain the reason for this alteration, until there fell into my hands the "Mexican Chronicle," written by Don Hernando de Alvarado Tezozomoc. By it there is clearly demonstrated the cause that led to the change in the order of reckoning which they had received from their ancestors, the Toltecs (who commenced their cycle with the symbol "ce Tecpatl," and had transferred the celebration of their secular festival to the year "ome Acatl.") The grand epoch of the Mexicans was that on which they made their exodus from Aztlan, their country, in order to come and populate the lands of Anahuac; and this was in the year "ce

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*The Mexican numbers are: Ce, 1; Ome, 2; Tei, 3; Nahui, 4; Macuilli, 5; Chicuacem, 6; Chicome, 7; Chicuei, 8; Chicuhnalmi, 9; Matlacti, 10; Matlacti oz ce, 11; Matlacti omome, 12; Matlacti omey, 13.

Tecpatl," corresponding to the year 1064 of the Christian era; but as the most of the year had passed, and the remainder was spent in wanderings, without making any settlement, until the year "11 Acatl" (1687), when they arrived at "Talisco," otherwise called "Acahualtzinco," where they remained for nine years, in which occurred the "ce Tochtli," which became the origin of the indiction, and they corrected their time, and began from it to reckon their cycle by the order of Chalchinhtlatonac, who was then their leader; but out of respect for their principal commander, Huitzilopochtli, whom they subsequently adored as the god of war, they transferred "the festival of fire" and "the binding of the years," on Xiuhmolpia, to the following "ome Acatl," because, in that year, Huitzilopochtli was born, on the day ce Tecpatl, as has been determined by the said author.

And in this region of Tlalixco their years were bound anew, and the first time of their new reckoning made, as is declared also by Chimalpain and others; and in the subsequent cycles, and in the places where they completed them, one finds in their pictures the hieroglyphic of "the binding," which is a handful of reeds tied together with numerical characters, to show how many years had elapsed, or how many festivals of fire were yet to come after that which they had celebrated in Tlalisco, or Acahualtzinco — the year "ome Acatl," corresponding to 1091 of the Christian era. Thus matters are determined in the same manner by the manuscripts of the Indian authors.

8. The epoch of the Mexicans, as has been stated, was the year "ce Tecpatl," but the beginning of their cycle was "ce Tochtli," which is the origin of the indiction, although a species of religious ceremony was consecrated to the honor of Huitzitopochtli, the year following "ome Acatl," celebrating in it the secular feast of Xiuhmolpia; hence, result two things, which it is necessary to notice, in order to obtain a perfect comprehension of the time alluded to in their histories. The first is, that having completed a cycle when they made their first festival at Tlalixco, and reckoning them in relation with the number of cycles, or Xiuhmolpille, since this festival (which was on the time they corrected their years, and determined to reckon them from the "ce

Tochtli") in order to find accurately the number of years in their histories, you must substract one unit from the number of "bindings of years," and multiply the remainder by 52, and you will have exactly the number of years elapsed from the first festival to the last Xiuhmolpilli.

The second thing is that, having commenced to count their first cycle after twenty-six years had elapsed from their exodus from Aztlan, which is their epoch, in order to find any particular year referred to in their histories, or of any special events, to the product of the cycles completed, reckoning from "ce Tochtli," you add, besides the passed years of the following cycles, the twenty-six which has elapsed since the exodus from Aztlan, and the sum will be the number of years reckoned from their epoch. For example, in the year "ce Acatl," the year in which the Spaniards entered Mexico, which was the first of the second indiction after the ninth "Xiuhmolpia," you will ascertain those that have elapsed since their epoch. If, to the product 416 of the 8 completed cycles, you add the 13 years that have elapsed of the first following indiction and the 26 years that have passed since the exodus from Azatlan until the first *Xiuhmolpia*, there results 455 years which have elapsed from the Mexican epoch to the arrival of the Spaniards, which sum, substracted from 1519 of our calendar, gives for the exodus from Aztlan the year 1064 of the Christian era, as has already been stated. $416+13+26=455$. $1{,}519-455=1{,}064$.

9. Each one of the years of their civil period consisted of 365 days, a distinction from the solar tropical year of 365 days, 5 hours, 48 minutes and 50 seconds; hence, this excess of almost 6 hours makes in each quadrennial the retrocession of one day in the commencement of the year.

At the end of 52 years the retrocession would amount to 13 days, which they knew perfectly well, and, in order to make the correction, they added to the last year, not precisely that number, but only 12½ days, as is clearly proved in the history of their chronology, and, consequently, 25 complete days at the end of their grand cycle of 104 years, which correction appears to be the most exact of any that has been invented in order to reduce the

civil to the solar years, since the small excess of 4 hours, 38 minutes and 40 seconds that there is over the 25 days, in a period of 104 years, will not amount to one entire day until the completion of more than five of these great periods, or 538 years, in which time the civil year will recede only one day from the solar year. Some historians, convinced by the close approximation which the days of the Mexicans had with ours in the later years of the conquest, concluded that one day was added in each quadrennial, like our bissextile, founded on a particular festival which they celebrated every four years; but this was a manifest error, for this feast was celebrated in honor of rekindling the fire every year, and to it they gave especial veneration under the title of "*Xiuhteucth*," the lord of the year. They celebrated it with the greatest solemnity when the same symbol returned with which they commenced the first "tricena" (tricene) of their cycle, which was, as we have seen, every four years. They had, notwithstanding, perfect knowledge that in each one of these intervals they were losing a day, which is evident from this same stone that we are going to describe; but the correction was not made until the end of the cycle (of 52 years), when they intercalated in one group the 13 days which they spent in festivals in honor of their secular gods, one of whom was this same "*Xiuhteuctli Tletl.*"

10. Each one of the 18 months that composed the year was made up of 20 days, which they reckoned consecutively from 1 to 20; and, in order to refer to any date, they spoke of the day, of such a number, of such a month, just as we say, the 13th day of May, without stating the day of the week corresponding, for each one of those 20 days had its symbol and particular name, including among them the same four symbols with which they designated their years. Of their 20 symbols, they formed another species of calendar, which was used by the priests and principal people.

The first calendar contained 18 months that were called "Tonalpohualli;" that is, "reckoning of the sun," or days, or "Cempohualilhuitl," feasts of 20 days; when they celebrated one especial festival at the end of each of these months, it was purely solar. But the second, in which figured the symbols of the day, corresponded to the apparent movements of the moon, and they

called it "Metztlapohualli;" that is, the "reckoning of the moon." And because they used it for the feasts which they celebrated daily for their divinations and for other superstitious rites, they gave it various other names; and, hence, in one of these same calendars it is called "*Cemilhuitlapohualliztli,*" "count of the ritual feast," and, in another of the highest superstition, was named "Tonalamatl," which literally signified nothing more than "decree of the sun," or of the days; but it possessed an allusion to the influences of the planets, although this species of calendar is described and represented in a distinct form and manner.

11. The numbers of the 18 months of the first calendar were varied in applying them to the purposes for which they were prepared, or to the seasons in which they occurred, or to the customs of the other Pueblos subjected to the Government of Mexico, and this variety in numbering them occasioned the great confusion which the writers about them fell into, thus, in regard to the order of arranging them as to their legitimate and primitive numbers, and likewise in regard to the figures by which they were symbolized; hence originated some apocryphal representations of this first calendar, and doubts as to which was the first month of the year, upon which matter we will not delay at present, reserving for hereafter to explain it all. We will only give notice, in passing, that one of the apocryphal calendars is that which you find at the beginning of the "Cortez Letters," which were printed in Mexico in 1770, under the title of "History of New Spain," written by its illustrious conqueror, Hernan Cortez, in which engraving, is represented the five days of the "nemontemi," contrary to the system observed by the Mexicans, who made use of them only for the correction of their time, and could not represent them in their calendars without interrupting the invariable arrangement of their months, and on that account some of the historians expressly assert that they were not included in their calendars. The truthful and legitimate representation is the one you find engraved by Dr. Gemelli in his book called "Giro del Mundo," revolution of the earth, copied from one given him by D. Carlos de Sigwenza, as we will see at the proper time.

12. The symbols and hieroglyphics which designated the 20 days were the following:

1. Cipactli—sea animal.
2. Ehecatl—wind.
3. Calli—house.
4. Cuetzpalin—lizard.
5. Cohuatl—serpent.
6. Miquiztli—death.
7. Mazatl—deer.
8. Tochtli—rabbit.
9. Atl—water.
10. Itzcuintli—dog.
11. Ozomatli—ape (female).
12. Malinalli—twisted plant.
13. Acatl—cane.
14. Ocelotl—tiger.
15. Quauhtli—eagle.
16. Cozcaquauhtli—Mexican eagle.
17. Ollin—sun's movements.
18. Tecpatl—flint.
19. Quiahuitl—rain.
20. Xochtli—flower.

Of these 20 days they composed their second calendar with such a disposition that they formed out of them a period of 260, not reckoning them from 1 to 20, as in the months of the first calendar, but from 1 to 13, and in this manner they divided the 260 days into 20 "tridecnas," which were after the fashion of our weeks, that each of these days carried with it its numerical character, in order to distinguish the symbols of one set of tridecnas from those of the others wherein they were repeated. These tridecnas represented the daily movements of the moon from east to west, from the time of conjunction until a few days after full moon, which interval of time, while, if it appeared at night above the horizon, is named *Ixtozoliztle*, or "watching," and after, when it begins to be hidden at night, until near conjunction, when it is visible by day in the heavens, it is called *Coehliztli*, or "sleeping," as they supposed it then slept at night. By the combination of these tridecnas and the solar cycle of 52 years, they formed a semi-solar period, most exact, for the purposes of astronomy, at the end of which you find verified the similar celestial phenomena which depend upon the movements of the sun and the moon, as the conjunctions, quadratures, oppositions and eclipses of both planets, whose period is contained in a species of calendar that was obtained by P. Fr. Diego Valdes, but he does not explain anything about it. In my work already referred to, I demonstrate the exactitude of this period, and give an extensive explanation of it, verified by eclipses that have been observed in the years passed, as well as those calculated for the future.

13. As the solar year consists of 365 days, and this calendar does not contain more than 260, some authors thought, and among them Torquemada, that it was merely a superstitious contrivance; but those who succeeded in discovering the exactitude it contained, eulogized the reckoning as ingenious, and esteemed it as a calendar of astronomy and chronology. The use of it was not known to the common people, but was understood only by the educated men and the priests, who used it in their religious rites, and in order to announce to the people the days appointed for their principal festivals. Its arrangement was in the following form:

1. Ce Cipactli.	1. Ce Ocetotl.
2. Ome Ehecatl.	2. Ome Quanhtli.
3. Yei Calli.	3. Yei Cozca quanhtli.
4. Nahui Cuetzpalin.	4. Nahui Ollin.
5. Maculi Cohuatl.	5. Macuili Tecpatl.
6. Chicuace Miquiztli.	6. Chicuace Quiahuitl.
7. Chicome Mazatl.	7. Chicome Xochitl.
8. Chicuei Tochtli.	8. Chicuei Chipactli.
9. Chicuhuahui Atl.	9. Chicuhuahui Ehecatl.
10. Matlactli Itzcuintli.	10. Matlactli Calli.
11. Matlactli once Ozomalli.	11. Matlactli once Cuetzpalin.
12. Matlactli omome Malinalli.	12. Maclactli omome Cohuatl.
13. Matlactli omey Acatl.	13. Matlactli omey Miquiztli.

And in the same manner you continue the other sets of thirteen days until you have formed twenty groups without encountering in all of them a similar symbol with the same number, and, as the first of these symbols is "Ce Cipactli," agrees always with that of the first day of the common solar year. In the first thirteen months that enter into the 260 days of the period, there is no need for persons who are instructed to refer to these dates by the number of the days of any of those months, but to designate the number and the symbol in the set of thirteen that corresponds. And in this form I have a history, in the Mexican language, with its figures and numerical characters, of the peregrinations which were made by the Toltecs Icxicohuatl and Quetzaltehueyac, copied from that which Boturini refers to, in the first volume of the catalogue of his museum, wherein are designated the years with their appropriate figures and the symbols of the days on which the incidents happened that are there related, together with the numerical characters that correspond to them.

14. As the first twenty trecenas *i. e.*, 20x13=260, do not contain more than thirteen months of the "first calendar," or 260 days, in order to complete the year of 365 days one must commence the reckoning of the (14th) fourteenth month with the same symbol and number, "Ce Cipactli," and run over the other five months and five days ($20\times5+5$), or 105 remaining days, repeating the same symbols and numbers of the first eight trecenas, the last of the five Nemontemi agreeing with the symbol "Ce Cohuatl," the first of the ninth trecena. But as the repetition of the same symbols and numbers would lead to confusion, as one could not tell whether you referred to the first thirteen months of the solar year, or to the last five, when you began to repeat the same symbol and numbers as in the first eight trecenas, they distingushed the last 100 "useful days" by using additional symbols, which they called "companions," and which they named jointly with those of the days already elapsed. So by this method one could not mistake, or doubt, as to the time of the year, on account of confusing them with the symbols and similar numbers of the days referred to in the arrangement of the "Second Calendar," or lunar cycle.

15. In order to fully understand this subject, one must take note that to each one of the symbols of the days the Indians imagined a special power over the day to which it belonged, and they made a special festival, and attributed to it a peculiar influence over sublunary affairs, just as signs and planets are supposed to possess in systems of astrology. But it was not only to the symbols of the day that they attributed this domination. They divided these influences also among the nocturnal signs, some of which had the same names and the same figures as the days, but they distinguished them by a certain device, which denoted that they were elevated to a higher dignity. Imagining to the first the rule from midday until midnight, and to the second, from midnight to the following midday; and to the figures that represented the second, they gave the title of "Companions," or "Lords of the night." There were nine, and they were distributed consecutively according to the order, which will be described, through the whole of the series of 260 days, or the twenty "trecenas." To these they

affixed no numerical character, and they were distinguished only by the order which they maintained (which was never altered in this calendar, unless it was in the "*Tonalmatl,*" in which the priests were accustomed to transfer some particular festival, in order to make it agree with some other, or for some special motive; but except for some such interruption, they continued in the same order as they commenced), as to the numbers that accompanied the symbols of the days.

The Indians regarded the "nine companions" with such consideration, as to bestow a special designation, the title of Quecholli which is the name of a bird of rich and beautiful plumage, that was held by them in great estimation, and they dedicated an entire month to its name. It was the symbol of lovers, and they invoked it at weddings, with epithalamiums, just as the Romans invoked Hymen. The names and the order of the nine companions are as follows:

Xiuhteuctli—*Tletl,* fire, Lord of the year.
Tecpatl—Flint.
Xochitl—Flower.
Cinteotl—Goddess of maize, or Ceres.
Miquiztli—Death.
Atl—Water, symbol of the Goddess *Chalchiuheueye.*
Tlozolteotl—Goddes of love, or Venus.
Tepeyototli—Goddess of the center of mountains.
Quiahuitl—Rain, symbol of the God *Tlaloc.*

16. Senor Boturini makes mention of these "Lords of the night," but he confuses them with another set of "companions" which was added by the Judicial Astrologers in the *Tonalamatl,* and it is to be wondered at since he had the original representation of this species of the superstitious calendar called "*The Ritual,*" and quoted it in § 30, number 2, of the Museum Catalogue, where you find the two sets of "companions" with the days of the "trecenas;" he did not know how to discriminate between those which were Lords of the night, and those signs which the Indians used for their false divinations, and heathen prognostications, and he has greatly confused the whole matter; although it is sufficiently difficult to comprehend perfectly this species of calendar, for it con-

tained in itself not only the catalogue of their idolatrous festivals, but also a multitude of superstitions, about which but very little mention has been made by the Indian Historians. In my work already mentioned, I give an explanation of the most important matter it contains, with an exact copy, which I had made of it, to which I have added two plans, that are not to be found in the original. The numbers and order of the nine companions, are the same as described by Don Christoval del Castillo, or Nehuatl Nicnotlacotl, a Tezcocano, an Indian who wrote in the Mexican language, a most erudite history of the migrations of his nation and of the conquest made by the Spaniards. He arranged them as is herewith shown, and they correspond to those which were figured in the first series after the hieroglyphics of the days of the "Tonalmatl."

TONAL.	QUECHOLLI.
1. Cipactli.	Xiuhteucli Tletl.
2. Ehacatl.	Tecpatl.
3. Calli.	Xochitl.
4. Cuetzpalin.	Cinteotl.
5. Cohuatl.	Miquiztli.
6. Mizquiztli.	Atl.
7. Mazatl.	Tlazolteotl.
8. Tochtli.	Tepeyoltotli.
9. Atl.	Tlalloc Quiahuitl.
10. Itzcuintli.	Tletl.
11. Ozomatli.	Tecpatl.
12. Malinalli.	Xochitl.
13 Acatl.	Cinteotl.

In this manner we see the days of this calendar accompanied with the symbols of the night, which serve to make known to what month of the year belong the days of the first eight trecenas which are repeated; because, when you would refer to some day that coincides in the first thirteen months of the first calendar, that is within the period of 260 days, with the second, there is no need to mention its "companion," but when the date in the 260 has passed, and it belongs to the last five months of the calendar, and in that case you see repeated the same symbols and numbers as in the 260, this is applied, for the purpose of discrimination, and as the "companion" in those five months properly corresponds, in this way is made known exactly the day of the solar month in question without the

necessity of numbering it; besides, as the "companions" were nine only, and the days of this calendar 260, they could not complete the period, and it was exceeded by one, which was Quiahuitl, which was in the ninth reckoning that they formed in order to harmonize it with the solar, that now happens to accompany "Cipactli," which in the beginning of the year was accompanied by "Tletl," and thus, though the same symbols and numerical characters were repeated, the "companions" that corresponded to the last five months were different. And for this reason some of the Indians never failed to quote them in their histories, to exalt the elegance of their narration, by the mention of the symbols of the days, conjointly with their "companions," that were referred to the first eight "trecenas," and which belonged also to the first five solar months, and also in the last with which they completed the year. We find this method occurring numerous times in the writings of Christoval Castillo.

17. In addition to the figures that represent the days, and the Lords of the night, you find in the Tonalamatl (and the said Castillo makes especial mention of them in treating of this second calendar), other figures which are placed in the principal angles of greater magnitude and with the entire figure represented; these are referred to by Boturini, in the said § 30, number 2, of the catalogue of his Museum. They represent the God that the Mexicans worshiped, and gave place to by pre-eminence, among the planets and celestial signs, attributing to them greater and more extensive powers than to the rest, not limiting it to a single day or night, but to the whole "trecena," which respectively corresponded to them; either alone, or accompanied with some of the same planets; endowing them also with all the appropriate powers they could imagine. One of these celestial signs was the statue, or idol (a figure combined of the God Huitzilopochtli and the Goddess Teoyaomiqui, war idols) which we may describe hereafter.

CATALOGUE OF THE SPECIMENS

IN THE

COLLECTION

OF THE

CINCINNATI SOCIETY of NATURAL HISTORY.

COMPILED BY

JOSEPH F. JAMES, CUSTODIAN,

Assisted by the Curators of the Various Departments.

THE following catalogue has been prepared in accordance with the instructions of the Executive Board of this Society. The present part, Mollusca, embraces, as far as they are known, the land, fresh water and marine shells belonging to the Society. It makes no pretense beyond being a list, and is arranged alphabetically for convenience of reference.

The most of the shells here catalogued are arranged in flat glass cases in the third story of the building of the Society. They are all numbered and labeled; besides the numbered list, there is a card catalogue giving the name, the locality and the donor, as far as can be done. This card catalogue is accessible to all, and by its means can be ascertained, in a few minutes, whether any particular shell is in the collection. This printed list will now supplement the written card catalogue.

The main object in the printing of this list is to enable the members and friends of the Society to see what is on hand and what is lacking. In some genera many species are represented. For instance: *Unio*, *Helix*, *Cypræa*, *Achatinella*, *Partula*, *Melania*, etc.

At present the collection, as arranged, follows as nearly as possible "Woodward's Manual of the Mollusca." Many improvements could be devised for the better display of the specimens, but lack of room is a serious obstacle and except in the Unionidæ, series of specimens are not attempted. Large series are interesting to

the student, but for the general public a selection of a few of each species is all-sufficient.

The attention of the members and friends of the Society is invited to this catalogue. Donations of desiderata are solicited, and exchanges will gladly be made for desired species. The numbers prefixed to the names indicate the number of specimens of each. Exchanges will be made whenever the number of specimens will warrant it.

J. F. J.

MOLLUSCA.

Acavus.
2 lactea, Müll.
4 Phœnix, Pfr.
Achatina.
10 fasciata, Müll.
2 fasciata, var.
2 pulchra, Linn.
1 variegata, Lam.
5 versicolor, Brod.
Achatinella.
2 abbreviata, Rve.
2 affinis, Newcb.
2 biplicata, Newcb.
2 bulimoides,
2 citrina, Migh.
3 colorata, Rve.
2 crassa, Newcb.
3 fulgens, Newcb.
5 fumosa, Newcb.
2 glabra.
2 magna, Adams.
2 Mighelsiana, Pfr.
2 mustelina, Migh.
2 nucleola, Gould.
3 obscura.
2 plicata, Migh.
2 producta, Rve.
3 reticulata.
2 rosea.
3 rubiginosa.
2 rugosa, Rve.
2 spirozona, Fér.
3 splendida, Newcb.
1 tessellata, Newcb.
3 tristis, Fer.
2 turritella, Fer.
3 variegata, Fer.
3 venusta, Migh.
4 veridans, Migh.
Acmæa.
5 patina, Esch.
8 pelta, Esch.
Acmæa.
5 persona, Esch.
2 scabra, Mull.
3 spectrum, Mull.
10 testudinalis, Han.
Adula.
2 stylina, Cpr.
Ælexia.
6 setifer.
Amnicola.
2 Cincinnatiensis, Anth.
22 longuinquas.
5 lustrica, Say.
5 pallida, Haldeman.
5 porata, Say.
Amphissa.
8 corrugata, Reeve.
4 versicolor.
Amycla.
7 carneata, Huds.
10 gansapata, Gould, var. Californica.
Anachis.
17 avara, Perkins.
Ancillaria.
1 glabrata, Sowb.
2 ventricosa, Lam.
Anculosa.
18 Ampla, Anth.
1 Anthonyi, Redfield.
5 carinata, Say.
1 costata, Pfr.
5 dissimilis, Say.
1 picta, Con.
15 plicata, Con.
3 prærosa, Say.
19 umbilicata, Weth.
Ancylus.
4 fuscus, Adams.
1 rivularis, Say.
Angitrema.
9 angulata, Wetherby.

Angitrema.
4 parva, Wetherby.
7 Whealteyi, Tyron.
Anodonta.
5 Californienses, Lea.
? cataracta, Say.
1 corpulenta, Coop.
5 cygnea, Drap.
25 edentula, Lea.
16 Ferussaciana, Lea.
1 Footiana, Lea.
1 grandis, Lea.
6 imbecilis, Say.
? lata-marginata, Lea.
2 Lewisii, Lea.
4 Oregonensis, Lea.
4 pavonia, Lea.
11 plana, Lea.
2 Salmonia, Lea.
3 subcylindrica, Lea.
2 suborbiculata, Say.
9 undulata, Lea.
2 Wahlematensis, Lea.
6 Wardiana, Lea.
Anomia.
3 aculeata, Gmel.
1 ephippum, L.
25 glabra, Verrill.
4 lampa, Gray.
Apollon.
2 gyrina, Linn.
Aporrhais.
1 occidentalis, Beck.
2 pes-pelicani, Lam.
Arca.
1 granulosa.
1 incongrua, Say.
1 pexata.
3 semitorta, Lam.
Argonauta.
2 argo, Linn.
Arionta.
3 (Helix) Gabbi, Newc.
1 (Helix) intercisa, Binney.
2 (Helix) ramentosa, Gould.
3 (Helix) Stearnsiana.
2 (Helix) Traski.
Astarte.
4 castanea, Say.
2 undata, Gould.
Astyris.
24 lunata, Dall.
Atys.
2 naucum, L.
Auricula.
1 auris-Medæ, Linn.
2 myosotis, Drap.
Avicula.
1 crocea.
2 hirundo, L.
Axina.
1 Zebuensis, Brod.
Barleeia.
16 subtenuis, Cpr.
Bithum.
20 nigrum, Stimpson.
Buccinum.
4 undatum, L.
Bulimus.
1 acutus, Brug.
2 aurantium, Carp.
2 daphius, Brod.
10 dealbatus, Say.
5 (Stenogyra) decollatus, Drap.
3 (Liostricus) Dcrman. W. G. B.
4 elongatus.
5 fulguratus, Jay.
1 hæmastomus, Scop.
4 Guadaloupensis, Fer.
7 hypnorum, Drap.
4 istoma, Sowb.
1 Keroensis, Garrett.
1 lubricus, Brug.
1 malleatus, Jay.
3 megasoma, Say.
4 montanus, Drap.
3 Mooreanus.
1 oblongus, Brug.
7 radiatus, Lam.
20 (Bulimulus), Scheideanus.
1 Seemanii, Dohrn.
3 zebra, Oliv.
Bulla.
29 ampulla, Linn.
10 nebulosa.
6 occidentalis, Adams.
2 striata, Brong.
3 (Haminea) virescens, Sowb.
Bullia.
1 monilifera, Val.
2 vittata, Linn.
Bysso-arca.
2 zebra, Sw.
Calliostoma.
4 (Trochus) annulatus Mach.
4 costatum, Mart.
Callista.
6 Dione, Linn.
Cancellaria.
3 cancellata, Lam.
7 reticulata, Lam.
Canidaria.
10 oniscus, Lam.
Canistrum.
2 perversum, Linn.

Capsa.
1 lævigata.
Cardium.
3 citrina.
3 corbis, Mart.
3 costatum, L.
2 edule, Linn.
1 hemicardium, L.
1 muricatum, Linn.
16 pinnulatum.
1 retusum, L.
2 substriatinum, Con.
Carelia.
4 adusta, Jacq.
Carveolla.
1 elegans.
Casmaria.
1 Ceylonica, Lam.
Cassidaria.
4 echinophora, Lam.
1 tyrrhena, Lam.
Cassidulus.
3 corona, Gmel.
3 melongena, Linn.
Cassis.
5 areolata, Brug.
1 canaliculata, Lam.
2 erinaceus, Brug.
1 flammea, Brug.
1 glauca, Brug.
7 rufa, Brug.
2 saburon, Brug.
5 sulcosa, Brug.
4 testiculus, Brug.
7 vibex, Brug.
2 zebra, Lam.
Cerastisolen.
1 cynumen.
Certhidea.
27 saccrata, Gould.
8 scalariformis, Say.
Cerithium.
7 aluco, Brug.
9 asper, L.
4 atratum, Gm.
3 baccatum, Kiener.
4 eriense, Val.
2 fluviatile, Potiez.
20 granosum, Kiener.
4 muricatum, Brug.
10 muscarum, Say.
5 nigrescens, Menke.
2 nodulosum, Lam.
8 obeliscus, Brug.
3 obtusum, Lam.
12 septemstriatum, Say.
25 sterco-muscarium.
1 sulcatum, Brug.
Cerithium.
6 vertagus, Brug.
Cerostoma.
3 Nuttallii, Con.
Chione.
2 simillima, Sowb.
Chiton.
2 Magellenicus, Ch.
Chlorostoma.
2 aureotinctum, Fost.
2 brunneum, Phil.
16 funibrata, Ag.
Chelyconus.
2 raphanus, Brug.
Chrysodomus.
3 dirus, Rve.
Cionella, (Ferussacia).
40 subcylindraceus, L.
Circe.
2 dispar, Desh.
3 rugifera, Lam.
Cistula.
5 catenata, Gould.
Clausilia.
2 cœrulea, Fer.
1 excrata, Menke.
2 marmenata, Muhl.
Clidiophora.
3 trilineata, Carp.
Cochlostyla.
1 Tucanensis, Pfr.
2 volubilis, Reeve.
Codackia.
2 tigrina, Lam.
Columbella.
6 fulgurans, Lam.
4 fuscata, Sowb.
3 Hebræ.
2 major, Sowb.
2 mendicaria, Lam.
40 mercatoria, Linn.
8 ocellata.
2 pardalina, Lam.
25 rustica, L.
3 strombiformis, Lam.
8 Terpsichore, Leath.
Concholepas.
6 Peruviana, Lam.
Conus.
1 araneosus, Brug.
4 Archiepiscopus, Brug.
1 betulinus, Linn.
6 Californicus, Hds.
2 catus, Brug.
20 echinulatus, Keiner.
2 episcopus, Brug.
1 floridanus.
5 fustigatus, Brug.

Conus.
1 generalis, L.
1 genuanus, Linn.
6 geographicus, Linn.
5 (Colonaxis) Hebræus, L.
2 Largillierti, Kiener.
4 lentigonsus, Reeve.
3 leonis.
5 litterratus, Linn.
1 (Rhizoconus) Maldivus, Brug.
3 marmoreus, Linn.
4 miles, Linn.
5 millipunctatus, Lam.
1 mussatella, Brug.
2 (Rhizoconus) mustellinus, Brug.
1 nodiferus, Kiener.
5 pulicarius, Brug.
2 regius, Chemn.
5 striatus, Linn.
1 suratensis, Brug.
7 (Lithoconus) tessallatus, Brug.
5 (Lithoconus) testudinarius, Lam
6 tulipa, Linn.
3 turdus-muscarius.
5 Virgo.
Corasia.
2 lais, Pfr.
2 Valenciennesii, Egd.
Corbis.
3 fimbriata, Lam.
Corbula.
2 luteola, Cpr.
Crassina.
6 elliptica.
Crepidula.
2 adunca, Sowb.
5 convexa, Say.
5 dorsata, Brod.
9 fornicata, Say.
2 lingulata, Gld.
6 plana, Say.
4 rugosa, Nutt.
Crucibillum.
3 spinosum, Sowb.
Cryptochiton.
1 Stellersi, Midd.
Cryptogramma.
2 flexuosa, Lam.
Cucullea.
2 auriculiferæ, Lam.
Cuma.
2 Kiosqueformis, Duclos.
Cyclas.
1 calyculata, Drap.
2 similis, Say.
4 sulcatum.
Cyclophorus.
1 involvulus, Mull.

Cyclophorus.
2 punctatus, Grub.
3 tigrinus, Sowb.
2 Woodianus, Lea.
Cyclostomus.
3 angustus, Adams.
1 auritus, Zeig.
2 Banksianus, Sowb.
5 Blandianus, Adams.
6 crenulosus, Adams.
8 elegans, Mull.
4 fasciatus, Gray.
1 fimbriatus, Sow.
1 flavulus, Lam.
4 granosus, Adams.
4 Hillianus, Adams.
3 hyacinthus, Adams.
4 igualabrus, Adams.
2 Jamaicensus, Gray.
4 Jayanus, Adams.
7 maculatus, Drap.
2 patulus, Drap.
1 scabriculus, Sow.
3 striolatus, Pers.
25 sulcatus, Drap.
6 variabilus, Adams.
Cyclotus.
3 planorbulum, Lam.
Cylindrella.
2 brevis, Pfr.
2 gracilis, Wood.
3 Mangeri, Wood.
5 rosea, Pfr.
Cypræa.
15 achatina, Solander.
2 alboginosa, Gray.
5 amethystica, Linn.
2 annulata, Gray.
10 annulus, Linn.
11 Arabica, Lam.
3 Arabicula, Lam.
3 argus, Linn.
19 arenosa, Gray.
2 arrosa.
9 asellus, Linn.
1 aurantium, Martyn.
3 (Trivia) Californica, Gray.
29 caput-serpentis, Linn.
27 carneola, Linn.
8 var.
11 caurica, Linn.
2 cervinetta, Kien.
2 cervus, L.
6 (Trivia) Childreni, Gray.
3 cicercula, Gmel.
1 clandestina, Linn.
4 coccinella, Lam.
4 cribaria, Linn.

Cypræa.
3 cylindrica, Bon.
2 divacea, Lam.
2 eburna, Barnes.
32 erosa, Linn.
5 errones, Linn.
11 (Trivia) Europœa, Mft.
15 exanthema, Linn.
3 felina, Gmel.
4 fimbriata, Gmel.
1 flaveola, L.
2 gangrenosa, Solander.
3 (Trivia) gemmula, Gould.
14 globosa, Gray.
14 helvolo, Linn.
1 hirundo, Linn.
1 histrio, Gmel.
2 Indica.
2 intermedia, Kiener.
23 Isabella, Linn.
4 limacina, Lam.
5 lurida, Linn.
32 lynx, L.
6 Maculata.
2 mappa, Linn.
6 mauritiana, Linn.
8 moneta, Linn.
3 mus, Linn.
10 nucleus, Linn.
8 obvelata, Lam.
3 ocellata, Linn.
20 oniscus, Lam.
2 onyx, Linn.
4 (Trivia) oryza, Lam.
2 pantherina, Soland.
16 pediculus, L.
2 picta, Gray.
2 pilula, Kiener.
2 poraria, Lam.
4 pustulata, Lam.
1 pyrum, Gmel.
3 quadri-maculata, Gray.
4 radians, Lam.
1 reticulata, Martyn.
4 rotunda, Kiener.
4 sanguinolenta, Gmel.
10 scurra, Chem.
3 (Trivia) Solandri, Gray.
2 staphylæa, Linn.
4 stercoraria, Linn.
2 tabesceus, Solander.
25 talpa, Lam.
4 testudinaria, Linn.
20 tigris, Linn.
1 turdus, Lam.
5 undulata, Solander.
2 ursellus, Gmel.
3 variolaria, Lam.

Cypræa.
6 vitellus, Linn.
3 zigzag, Linn.

Cypræovula.
2 capensis, Gray.

Cyrena.
1 Bengalensis.
1 Caroliniana, Bosc.

Cyprina.
4 Islandica, Lam.

Cytherea.
1 erycina, Lam.
5 gigantea, Lam.
4 maculata, L.
1 pectinata, Linn.
1 scripta.

Delphinula.
2 distorta, Lam.
1 licineata, Lam.

Dentalium.
25 pretionum.

Discina.
2 concentrica, Lam.

Docina.
1 Dunkeri, Phil.

Dolium.
2 fasciatum, Lam.
3 galea (?), Lam.
5 maculatum, Lam.
3 olearium, Lam.
6 variegatum, Lam.

Donax.
2 assimilis.
3 Californicus, Con.
3 denticulata, Linn.
9 dentifera, Hanl.

Dorcasia.
3 (Helix) Berlanderana.

Dreissena.
3 polymorpha, Pallas.

Dumatocera.
5 vitrea, Lesson.

Eupleura.
4 Tampaensis, Con.

Eburna.
4 areolata, Lam.
1 Ceylondica, Lam.
2 Japonica, Rve.
3 spirata, Lam.

Entalis.
3 striolata, Simpson.

Eulima.
3 micans, Cpr.

Eurycœlon.
11 gibberosa, Lea.
20 lepida, Lea.

Euryparypha.
2 arabica, Roth.

Euryta.
3 aciculata, Hds.
Fasciolaria.
2 distans, Lam.
1 filamentosa, Lam.
2 granosa, Brod.
1 princeps, Sowb.
3 trapezium, Lam.
5 tulipa, Lam.
Ficus.
3 Dussumieri, Valenc.
4 reticulatus, Lam.
2 ventricosa, Sow.
Fissurella.
4 pustula, L.
5 volcano, Reeve.
Fusus.
2 articulatus, Lam.
7 circireus, Say.
5 filosus, Lam.
2 longissimus, Lam.
1 morio, L.
3 Syracusanus, L.
6 tuba, Gmel.
3 tuberculatus, Lam.
3 turriculus, Mont.
Galatea.
1 radiata, Gmel.
Gilia.
6 artilis.
Glaudina.
3 fusco-lineata.
1 parallela.
9 truncata, Say.
Glyphis.
2 aspera, Esch.
Gnathodon.
125 cuneatus, Gray.
Goniobasis.
7 ampla, Anth.
9 aterina, Lea.
12 carina-costata, Lea.
10 crebricostata, Lea.
17 cristata, Anth.
12 Cumberlandensis, Lea.
12 Deshaysiana, Lea.
3 Haysiana, Lea.
7 Hydei, Conrad.
10 macella, Lea.
9 nassula. Con.
12 nitens, Lea.
4 olivula, Con.
3 plicifera, Lea.
7 porrecta, Lea.
2 rubicunda, Lea.
17 sparus, Lea.
14 striato-plicata, Weth.
21 symmetrica, Hald.

Goniobasis.
9 Vanuxemensis, Lea.
16 varians, Lea.
3 Virginica, Gmel.
6 vitatella, Lea.
Gyralus.
4 parvus, Say.
Haliotus.
5 asinina, L.
5 Cracherodii, Leach.
Harpa.
3 articularis, Lam.
5 minor, Lam.
1 nobilis, Lam.
5 rosea, Lam.
7 vetricosa, Lam.
Helicina.
3 Adamsiana, Pfr.
5 agglutinans, Sowb.
2 aurantia, Gray.
3 cincta, Pse.
1 faba, Pse.
2 Hollandii, Adams.
2 neritella, Lam.
3 orbiculata, Say.
1 palliata, Sowb.
6 picta, Pse.
3 pisum, Phil.
2 rufescens, Pse.
3 solida, Pse.
24 submarginata, Gray.
7 tropica, Jay.
Helicodiscus.
4 fimbriatus, Weth.
8 lineatus, Say.
Helicophante.
1 falconaria, Reeve.
Helicostyla.
1 cocomelous, Pfr.
Helix—See Arionta, Dorcasia, Mesodon, Polygyra.
4 acetabulum, Pse.
2 acuta, Lam.
25 (Mesodon) albolabris, Say.
5 var, dentata.
2 var elevata.
2 algiera.
1 Anthoniana, Adams.
30 appressa, Say.
11 arbustorum, L.
5 arrosa, Gld.
18 aspersa, Muller.
2 auricoma, Fer.
4 auriculata, Say.
5 auriformis, Bland.
3 avava, Say.
4 Ayarsiana, Newc.
1 badia, Fer.

Helix.
2 barbigera, Redfield.
2 Bonplandii, Lam.
2 Bridgesii, Newc.
2 bucculenta, Gld.
1 bulbus, Morch.
4 Californiensis, Lea.
4 candissima, Drap.
5 cantiana, Montague.
6 Carpenteriana, Bland.
2 Carthusianella, Drap.
5 cellaria, Lam.
4 cereolus, Muhlfield.
2 Chamissoi, Pfr.
10 (Camæna) cicatricosa, Mull.
1 cincinnus, Sowerby.
4 circinata
1 citrina.
1 Clarkei, Lea.
9 clausa, Say.
9 Columbiana, Lewis.
5 conspecta, Bland.
1 cornea, Drap.
2 dentifera.
1 cpesareana, (?) Fer.
3 Cumberlandiana, Lea.
5 devia, Gould.
9 (Polygyra) Dorfeuilliana, Lea.
1 Downieana, Blanc.
2 Dupithonarsi, Desh.
1 Edvardsi, Bland.
29 elevata, Say.
10 ericetorum, Pfr.
4 exarata, Pfr.
22 exoleta, Binney.
2 fabrifacta, Pse.
22 fallax, Say.
3 fastigans, L. W. Say.
2 febigera, Bland.
3 ficta, Pse.
2 fidelis, Gray.
17 fraterna, Say.
1 fruticum, Drap.
1 gaultereana.
5 griseola, Pfr.
5 hamastoma, Linn.
2 harpa, Say.
3 Hazardi, Bland.
22 hirsuta, Say.
1 hispida, L.
2 Hopetonensis, Shutl.
12 hortensis, Mull.
3 Huaheimensis, Pfr.
3 incarnata, Mull.
2 incerta, Drap.
18 inflecta, Say.
4 (Polygyra) Jacksoni.
4 jejana, Say.

Helix.
3 (Stenotrema) labrosa, Bld.
10 labyrinthica, Say.
1 lactea, Mull.
10 lapicida, Linn.
2 leporina, Gould.
3 Leaii.
1 Listeri, Gray.
4 loricata, Gld.
1 lutescens, Alenke.
1 Mandarina, Gray.
1 major, Binney.
2 marginata, Mull.
2 marginella, Gmel.
2 maxillata, Gld.
3 Mayallii.
1 McMurrayi.
1 melanostoma, Drap.
9 Mitchelliana, Lea.
2 Mobilians, Lea.
19 monodon, Rucket.
1 monozonalis, Lam.
34 multilineata, Say.
1 muralis, Fer.
5 naticoides, Jenr.
21 nemoralis, Linn.
3 nemoralis, var. hybrida, Pocket.
3 Newberryana, W. G. B.
9 Nicilensis, Fer.
2 Nickliniana, Lea.
2 nitens, Migh.
2 nitida, Mull.
2 obstricta, Say.
1 obvoluta, Mull.
22 palliata, Say.
3 pallida.
3 patris, var.
13 Pennsylvanica, Green.
2 peracutissima, Adams.
1 personata, Mich.
4 pisana, Mull.
1 pomatia, Linn.
1 porphyritia.
2 postelliana, Bland.
4 probosidea.
22 profunda, Say.
20 pulchella, Mull.
7 (Polygyra) pustula, Fer.
4 reticulata, Pfr.
2 Rhodostoma.
9 Ræmeri, Pfr.
5 Roiseyana, Fer.
1 rotundata, Drap.
6 rufescens, Pennant.
7 Rugeli, Shutl.
7 (Polygyra) Sampsonii, Weth.
5 Sayii, Binney.
2 scuta, Pse.

Helix.
19 septemvolva, Say.
1 sequoicola, Cooper.
3 serpentina, Fer.
1 Simsonii.
5 spinosa, Lea.
12 stenotrema, Fer.
2 subrutila, Migh.
3 subtilis, Anton.
1 sylvatica, Fer.
2 Texasiana, Moricand.
25 thyroides, Say.
2 Townsendiana, Lea.
35 tridentata, Say.
3 Troostiana, Lea.
2 tridiculata, Binney.
13 uvulifera, Shutl.
8 vermiculata, Mull.
4 verticillata, Parr.
23 virgata, De Costa.
6 virgata, var submaritima.
6 vivia.
6 volvovis, Parreyes.
2 (Triodopsis) vultuosa Gld.
1 Wheatleyi, Bland.
1 (Gonostoma) Yatesi, J. G. C.

Hellisoma.
3 ammon, Gould.

Hemiplecta.
2 Nov-Hibernæ, Quoy.

Heterodonax.
2 bi-maculata, Linn.

Hinnites.
2 gigantea, Gray.

Hippopus.
3 maculatus.

Hydrocera.
3 bulimoides, Wom & Jacq.
2 elongata, Pse.
3 Huapeinensis, Pfr.
2 robusta, Pse.

Ianthina.
30 bifida, Nutt.
5 communis, Lam.

Ilyanassa.
17 obsoleta, Stimp.

Imperator.
5 imperialis, Chemn.

Io.
2 fluviatilis, Say.
3 spinosa, Lea.

Iopas.
5 sertum, Brug.

Ischnochiton.
2 Cooperi.

Isocardia.
1 cor, L.

Kalherina
2 tunicata, Sowb.

Lacuna.
2 pertusa, Con.
7 vincta, Turton.

Leptothyra.
11 sanguinea, Cpr.

Liguus.
4 fasciatus, Mull.

Lima.
4 squamosa, Lam.

Limax.
4 maximus, Linn.

Limnæa.
2 auricularia, Drap.
12 caperata, Say.
20 catuscopium, Say.
3 columnella, Say.
22 desiduosa, Say.
15 elodes, Say.
16 humilis, Say.
15 palustris, Mull.
11 reflexa, Say.
15 stagnalis, Linn.
23 umbrosa, Say.
4 zebra, Tryon.

Lioplax.
8 sub-carinata, Say.

Lithasia.
6 florentiana, Lea.
19 plicata, Wetherby.

Lithocomis.
1 emaciatus, Reeve.

Lithodomus.
4 lithophaga, L.

Littorina.
15 angulifera, Lam.
6 asper, Phil.
20 irrorata, Say.
13 littorea, Menke.
3 obesa, Sowb.
4 palliata, Gould.
8 picta, Phil.
3 planaxis, Nutt.
18 rudis, Gould.
7 scutulata, Gould.
11 tenebrosa, Gould.
15 ventulata, Gould.

Lottia.
10 gigantea, Gray.

Lucidella.
1 aureola, Gray.
2 granosa, Gray.

Lucina.
4 canaria.
2 ebuonea, Reeve.

Lunatia.
4 heros, H. and A. Ad.

Machæra.
3 patula, Dixon.
Macoma.
9 inconspicua, Pr. and Sowb.
2 inquinata, Desh.
3 nasuta, Con.
2 sabulosa, Morch.
Macroceramus.
4 Gossei, Pfr.
3 lineatus, Brug.
Macrocyclis.
25 concava, Say.
1 Duranti, Newc.
2 Hemphilli, var. W. G. B.
6 Vancouverensis, Lea.
Macron.
3 lividus, A. Ad.
Mactra.
1 arctata, Con.
1 grandis.
2 solidissima, Chem.
2 truncata.
Malea.
1 latalabris, Valenc.
4 pomum, Lam.
Maleagrina.
7 margaritifera, L.
Malleus.
1 albus, Lam.
3 vulgaris, Lam.
Margarita.
9 cinerea, Couth,
4 helicina, Moll.
1 occidentalis.
Margaritana.
2 calceola, Lea.
5 complanata, Barnes.
1 confragosa.
10 dehiscens, Say.
12 deltoidea, Lea.
3 fabula, Lea.
2 Holstoniana, Lea.
5 margaritifera, Lea.
30 marginata, Say.
29 rugosa, Barnes.
4 undulata, Lea.
Marginella.
5 cœrulescens, Lam.
4 Jewettii.
14 labiata.
2 lineata, Lam.
8 longivaricosa, Lam.
6 margarita, Keiner.
9 monilis, Linn.
1 Storeri.
Marisa.
2 cornuarietis, Sowb.
Melampus.
3 ater, Mühl.
4 bidentatus, Say.
3 castaneus, Mühl.
24 lineatus, Say.
8 luteus, Quoy.
5 olivaceus, Cpr.
4 pusillus, Pfr.
3 striatus, Pse.
Melania.
4 altilis, Lea.
23 amarula, Lam.
3 annulifera, Con.
2 armigera, Say.
2 aspera, Lam.
1 Boykiniana, Lea.
6 bulla, Conrad.
1 coma, Con.
1 cylindracea, Con.
6 depygis, Say.
2 Duttoniana, Lea.
3 elongata, Lea.
2 fuliginosa, Say.
5 glabrata, Lea.
3 gracilis, Lea.
3 Haysiana, Say.
1 Hollandri.
4 integra, Say.
4 laqueata, Say.
1 lima, Con.
3 Newcombii, Lea.
7 nupera, Say.
23 obovata.
6 pernodosa, Lea.
1 pyrencleata, Con.
3 salebrosa, Conrad.
4 semicarinata, Say.
1 spixiana, Lea.
2 subularis, Con.
2 vestita, Conrad.
1 visata, Conrad.
50 Virginica, Say.
Melantho.
6 coarcata, Lea.
9 decisa, Say.
2 (Paludina) genicula, Con.
6 heterostrophia, Kirtland.
25 integra, Say.
16 ponderosa, Say.
9 subsolida, Anth.
Melo.
2 Diadema, Lam.
4 Indica, Gmel.
Menetus.
4 opercularis.
Mesodesma.
3 Chilensis, D'Orb.

Mesodon.
2 (Helix) Wetherbyi, Bland.
Microphysa.
4 vortex, Pfr.
Mitra.
3 adusta, Lam.
2 cadaverosa, Reeve.
2 casta, Swainson.
1 corrugata.
1 dactylus, Lam.
3 episcopalis, Lam.
2 fenestrata, Lam.
1 granitina, Lam.
8 granulosa, Lam.
2 Isabella, Swainson.
4 melongena, Lam.
5 pontificalis, Lam.
1 retusa.
1 scabriuscula, Lam.
2 versicolor, Martin.
2 zebra.
Modiola.
2 capax, Con.
3 plicatula, Lam.
5 tulipa, Linn.
Moera.
7 Gouldii, Hand.
Monoceras.
5 cingulatum, Kien.
6 crassilabrum, Lam.
Monoceros.
4 eugonatum, Con.
6 lapilloides, Mull.
1 lugubre, Sow.
Monodonta.
3 labio.
1 papillosus, Lam.
Mophalia.
4 Hindsii, Gray.
2 Magdalinsis, Hds.
2 muscosa, Bland.
Murex.
2 brandaris, Linn.
1 cornutus, Linn.
6 corrugatus, Sowb.
4 haustellum, Linn.
4 pinnatus, Wood.
6 radix, Gmel.
5 ramosus, Linn.
12 regius, Wood.
2 sexatilis, Linn.
5 tenuispina, Lam.
6 trigonulus, Lam.
Mya.
2 arenaria, Linn.
2 edulis.
1 truncata, Linn.

Mytilus.
3 Californianus, Con.
3 demissus.
13 edulis, Linn.
8 hammatus, Say.
1 perna, Soland.
1 smaragdinus, Chem.
Myurella.
4 simplex, Cpr.
Nacella.
5 palacea, Gould.
Nanina.
1 aulica, Sowb.
1 raregutlata, Mouss.
Nassa.
19 arcularia, Linn.
2 canaliculata, Lam.
3 Cooperi, Forbes.
1 coronata, Brug.
1 crenulata, Brug.
1 Cuvierii, Payer.
1 fossata, Gould.
2 gibbisula, Linn.
6 Jacksoniana, Kiener.
6 luteostoma, Kiener.
2 mutabilis, Linn.
1 neritea, L.
4 obscura, Kien.
8 papillosa, Linn.
2 pullus, Linn.
7 reticulata, L.
1 rufula, Kiener.
4 scalariformis, Val.
10 suturalis, Lam.
4 tegula, Rve.
15 vibex, Brug.
Natica.
3 conica, Lam.
8 caurena, L.
11 mamilla, L.
10 melanostoma, Gmel.
1 millepunctata, Lam.
9 stercus-muscarum.
Nautilus.
4 pompilius, L.
Navicella.
3 Freycincta, Richez.
Nerita.
3 versicolor, Gmel.
Neritina.
5 albicilla, Lam.
2 atrata, Lam.
2 chlorostoma, Brug.
5 corona, L.
5 latissima, Brod.
3 Mertoniana, Rd.
2 microptera.
8 morio.

Neritina.
8 peloronta.
7 picea, Wood.
5 picta, Sowb.
12 piseformis, Rechez.
3 polita.
14 reclivata, Say.
9 reticulata, Sowb.
8 Souleyetana, Rechez.
15 spinosa, Budgin.
2 Tahitensis, Less.
14 vespertina, Nutt.
6 Virginiea, Lam.
Neverita.
3 reclusiana, Petit.
Nucula.
2 margaritacea, Lam.
3 proxima, Say.
Nuttalliana.
3 scabra, Reeve.
Obba.
3 marginata, Mull.
Obeliscus.
4 dolebratus, Linn.
Ocinebra.
2 Poulsonii, Cpr.
Oliva.
3 angulata, Lam.
5 Braziliana, Lam.
3 candida.
12 carneola, Gmel.
18 Duclosiana, Jay.
4 episcopalis, Lam.
24 erythrostoma, Lam.
4 fulminaus, Lam.
5 irrisaus, Lam.
11 Ispidula, L.
1 jasperidæ, Lam.
24 leucophæa, Lam.
30 litterata, Lam.
5 maura, Lam.
8 Melchersi, Mke.
50 mutica, Say.
4 (Utriculina) nebulosa, Lam.
14 Peruviana, Lam.
3 ponderosa.
2 porphyrea, L.
22 reticularis, Lam.
4 sanguinolenta, Lam.
3 scripta, Lam.
2 splendidula, Sowb.
5 talpa.
2 tassellata, Lam.
5 textilina, Lam.
3 tremulina, Lam.
5 undata.
1 undata, var. bicincta, Lam.
5 undata, var. inflata, Lam.

Oliva.
2 venulata, Lam.
Olivella.
4 amazona, Lam.
18 biplicata, Sow.
4 daura, Mawe.
90 oryza, Lam.
20 sapatella.
6 semisarita, Gray.
3 undatella, Lam.
Omphalina.
5 exiguus, Stimp.
3 ferrea, Morse.
Ophiocardelus.
3 Brownii, Phil.
Orthalicus.
5 undatus, Brug.
Ostrea.
1 edulis, L.
4 lurida, Cpr.
2 Virginiana, Lister.
Ovula.
14 gibbosa, Lam.
4 oviformis, Lam.
2 verrucosa, Lam.
2 volva, Lam.
Pachydesma.
2 crassatelloides, Con.
Pachypoma.
1 cœlatus, Chem.
1 helicina, Gmel.
Paludina.
1 fasciata, Mull.
2 impura, Drap.
1 Maheyana, Grat.
2 naticoides, Fer.
3 unicolor, Lam.
2 viridis, Drap.
Parallelopipedon.
1 tortuosa, Linn.
Parapholas.
3 Californianus.
Partula.
2 abbreviata, Pse.
3 affinis, Pse.
2 bilineata, Pse.
2 crassilabrum, Pse
3 faba, Brug.
2 Garretti, Pse.
3 globosa, Pse.
3 gracilior, Pse.
3 Hebe, Pfr.
3 hyalina, Brod.
3 labiata, Pse.
2 lineolata, Pse.
3 nucleola, Pse.
3 Otaheitensis, Brug.
2 recta, Pse.

Partula.
5 rosea, Brod.
3 simulans, Pse.
5 solidula, Reeve.
3 trilineata, Pse.
3 turricula, Pse.
6 varia, Brod.
Patella.
15 athletica.
8 testudinalis, Muller.
4 vulgata, L.
Patula.
40 alternata (varieties), Say.
3 asterisca, Morse.
2 Haydeni, Gall.
1 Idahoensis, Newb.
15 lineata, Say.
6 mordax, Shutl.
40 perspectiva, Say.
30 solitaria, Say.
20 striatella, Anth.
1 strigosa, Gould.
Pecten.
3 æquisulcata, Cpr.
5 concentricus.
5 viradians, Lam.
2 latiauritus, Con.
2 maximus.
1 nodosus, Lam.
12 opercularis, L.
2 pallium, Linn.
1 tennicostatus, Migh.
7 varius, L.
Petricola.
5 pholadiformis, Lam.
Phasianella.
7 australis, Gmel.
4 compta, Gould.
1 solida, Desh.
Pholadidea.
2 penita, Con.
Pholas.
2 candida, L.
2 costata, Linn.
3 dactylus, L.
Physa.
5 anatina, Lea.
6 ancillaria, Say.
3 costata, Newc.
8 crocata, Lea.
2 Curltoni, Tryon.
3 elliptica, Lea.
6 febigera, Lea.
12 Gabbii, Tryon.
27 gyrina, Say.
7 heterostrophia, Say.
11 Hildrethiana, Lea.
25 humerosa.
Physa.
5 Sayii, Tappan.
10 scalaria.
40 solida, Phil.
2 Wolfiana, Lea.
Pinna.
4 seminuda, L.
Pisidium.
2 abditum, Hald.
9 æquilaterale, Prime.
9 occidentalis.
8 compressum, Prime.
10 variabile, Prime.
8 ventricosum, Prime.
Placuna.
1 placenta, L.
Planaxis.
7 Sandwichensis, Con.
6 sulcata, Lam.
Planorbis.
14 bicarinatus, Say.
11 (Planorbella) campanulatus, Say.
2 complanatus, Pfr.
1 contortus, Drap.
2 corneus, Muhl.
1 corpulenta, Say.
4 deflecta.
5 Duryi, Weth.
5 (Menetus) exacutus, Say.
4 glabratus, Say.
2 hirsuta, Gould.
7 lentus, Say.
2 leucostoma, Mich.
2 marginatus.
3 minuta.
20 opercularis, Gould.
1 parvus.
1 tricarinata.
30 trivolvus, Say.
12 tumens, Carp.
Platyodon.
2 cancellatum, Con.
Pleurocera.
4 Dohertyana, Judge.
Pleurotoma.
3 australis, Lam.
1 Babylonica, Lam.
3 crispa, Lam.
2 diadema, Kein.
Polygyra.
2 (Helix) espiloca, Row.
3 (Helix) pustuloides, Bland.
Pomatias.
11 obscurus, Drap.
Pomatiopsis.
5 lapidaria, Say.
Pomus.
5 depressa, Say.

Proserpina.
7 nitida, Sowb.
Prunum.
6 diaphana, Kien.
Pseudachatina.
1 Krausii, Reeve.
Pterocera.
3 aurantia, Lam.
7 chiragra, Lam.
7 lambis, Lam.
1 millepeda, Lam.
1 scorpio, Lam.
Pterontus.
3 festivus, Hds.
Punctum.
10 minutissimum, Say.
Pupa.
40 armifera, Say.
4 (Isthmia) Bollesiana. Morse.
40 Californica, Rowell.
1 Cincinnatiensis, Judge.
10 (Leucochila) contracta, Say.
2 corticaria, Say.
2 dolium, Drap.
12 (Carychium) exignum, Say.
20 fallax, Say.
7 muscorum. Pfr.
5 (Isthmia) ovata, Say.
2 pagodotus, Drap.
5 pellucida. Pfr.
15 pentadon, Say.
3 Rowelli, Newc.
12 rupicola, Say.
2 uva, L.
Purpura.
2 anaxares, Duclos.
1 aptera, De Blainv.
30 astrina, var. fuscata.
2 bufo, Lam.
4 caniculata, Don.
1 carinifera.
5 cataracta, Lam.
4 chocolatum, Duclos.
12 colostoma.
2 columnellaris, Lam.
5 Conradi.
3 costata, Kiener.
3 crespata, Miod.
3 francolinus, Kiener.
8 hæmostoma, Lam.
3 harpa, Conr.
1 intermedia, Kiener.
20 lapillus, Lam.
3 macrostoma.
2 mandinella, Lam.
3 neritoides, Lam.
2 patula, Lam.
Purpura.
2 Persica, Lam.
2 planospira, Lam.
2 Rudolphii, Lam.
6 saxicola, var. fuscata, Forbes.
6 saxicola, var. ostrina, Gould.
5 squamosa, Lam.
1 succincta, Lam.
4 undata, Lam.
Pyrula.
6 perversa, Lam.
3 rapa, Lam.
3 spirata, Lam.
2 vespertilio, Lam.
Pythia.
3 argenoillier, Pfr.
2 striata, Reeve.
Ranella.
2 bufonia, Lam.
2 Californica, Hds.
1 cruentata, Sowb.
4 granifera, Lam.
2 granulata, Lam.
1 leucostoma, Lam.
1 spinosa, Lam.
2 ventricosa, Brod.
Rangia.
4 cyrenoides, Con.
Registoma.
3 complanata, Pse.
Ricinula.
9 albolabris, De Blain.
3 clathrata, Lam.
1 digitata, Lam.
4 horrida, Lam.
9 muricina, De Blain.
Rostellaria.
2 curvirostris, Lam.
Rotella.
14 lineolata, Lam.
4 rosea, Lam.
3 suturale, Linn.
Rowellia.
3 radiata, Cpr.
Sanguinolaria.
1 rugosa.
Scalaria.
3 communis, Lam.
2 pallasi, Kiener.
6 pretiosa, Lam.
Scaphander.
2 liguarius, L.
Scapharca.
4 transversa, Ad.
Schizostoma.
4 Alabamense, Lea.
3 incisum, Lea.
4 pumilum, Lea.

Scurria.
3 mitra, Esch.
Segmentina.
20 armigera, Say.
Semile.
2 decisa, Con.
Septifer.
5 bifurcatus, Reeve.
Siliqua.
4 costata, Say.
Siliquaria.
1 gibba, Speng.
Solarium.
12 granulatum, Lam.
3 perspectivum, Lam.
1 variegatum, Gmel.
Solecurtis.
2 Californianus, Con.
3 radiatus.
Solen.
2 ensis, L.
1 siliqua.
3 truncatus, Wood.
Somatogyrus.
2 isogonus, Say.
(Paludina) pallida, Lea.
3 sub-globosus, Say.
Sphærium.
2 fabilis, Prime.
9 occidentale, Say.
6 rhomboideus, Say.
3 simile, Say.
6 striatum, Say.
Spiroglyphis.
15 lituella, Morch.
Spisula.
9 solidissima, Gray.
Spondylus.
4 gæderopus, L.
5 princeps, Gmel.
Stenogyra, (see Bulimus).
5 octonoides, C. B. Adams.
Streptaxis.
1 contusa, Fer.
Strombus.
3 alatus, Gmel.
3 auris-Dianæ, Lam.
4 bituberculatus, Lam.
2 bubonius, Lam.
2 canarium, Linn.
4 floridus, Lam.
1 fusiformis, Sowb.
1 galæatus, Wood.
4 gallus, Linn.
14 gibberulus, Lam.
4 gigas, Linn.
1 labiosus, Wood.
2 lentiginosus, Linn.

Strombus.
3 luhuanus, Linn.
3 Peruvianus, Swain.
13 plicatus, Lam.
4 pugilis, Linn.
2 succinctus, Linn.
1 tricornis, Lam.
1 tridentatus, Gmel.
3 urceus, Linn.
1 variabilis, Swain.
6 vittatus, Linn.
Strophia.
2 glans, Kier.
5 striatella, Fer.
Struthiolaria.
2 nodulosa, Lam.
Stylodon.
2 unidentatus, Chem.
Succinea.
1 aurea, Lea.
5 avara, Say.
3 campestris, Say.
12 effusa, Shutl.
10 luteola.
4 Nuttalliana, Lea.
20 obliqua, Say.
4 Oregonensis.
6 ovalis, Gould.
5 Sillimani, Bland.
4 Totteniana, Lea.
Tapes.
3 litterata, Linn.
4 staminea, var. diversa, Con.
4 sulcaria, Lam.
2 tenerrima, Cpr.
3 turgida, Lam.
Tebenophorus.
10 carolinensis, Bosc.
Tellina.
1 lingua-felis, L.
6 radiata, Linn.
2 virgata, L.
Terebellum.
8 subulatum, Lam.
Terebra.
7 Babylonica, Lam.
10 coerulescens, Lam.
5 crenulata, Lam.
3 dimidiata, Lam.
2 duplicata, Lam.
2 Dussumierii, Kiener.
22 gemmulata, Kiener.
12 maculata, Lam.
3 muscaria, Lam.
6 occulata, Lam.
1 pertusa, Swainson.
1 robusta, Hinds.
1 (Acus) strigata, Sowb.

Terebra.
2 subulata, Lam.
Thalessa.
1 melones, Duclos.
Trachydermon.
2 ruber, Carpt.
Tridacna.
7 gigas, Lam.
2 squamosa, Chem.
Triquetra.
2 corrugata, Lea.
1 subviridis, Klein.
Tritia.
16 trivittata, H. and A. Ad.
Triton.
2 anus, Lam.
2 canaliferum, Lam.
5 chlorostomum, Lam.
2 clathratum, Lam.
2 corrugatum, Lam.
1 cutaceum, Lam.
6 distortum, Schub.
1 lampas, Lam.
2 nodiferum, Lam.
1 pirum, Lam.
13 rubecula, Lam.
6 sub-distortum, Lam.
1 succinctum, Lam.
1 tripus, Lam.
3 tuberosum, Lam.
2 variegatum, Lam.
Trochabella.
1 Tankervilii, Gray.
12 pulchella, Gray.
Trochita.
6 radians, L.
Trochotropis.
1 costellatus.
Trochus.
1 brevispina, Lam.
4 cinereus, var. electissimus.
3 conulus, L.
2 costulatus, Lam.
5 granulatus, Born.
1 Indicus, Gmel.
2 Niloticus, L.
1 pellis-serpentis, Wood.
3 Pharaonis, L.
1 spinulosus, Lam.
6 (Pomaulax) undosus, Wood.
6 virgatus, Gmel.
Trohiscus.
1 Norrisi, Sowb.
Trophon.
6 scalariformis, Gould.
Tropidaphon.
1 occlusus, Morch.
Truncatella.
4 cylindracea, Pse.
Tryonea.
40 protea.
Trypanostoma.
29 alveare, Con.
11 angulata, La.
6 annuliferum, Con.
20 canaliculatum.
8 elevatum, Say.
4 Formanii, Lea.
9 plicatum, Tryon.
21 prasinatum, Con.
6 pyrenellum, Con.
7 Toreniana, Lea.
22 undulatum, Say.
Tulitoma.
5 augulifera, Lea.
7 bimonilifera, Lea.
5 magnifica, Con.
Turbinella.
4 cornigera, Lam.
5 craticulata, Lam.
1 pugillaris, Lam.
3 pyrum, Lam.
2 rapa, Lam.
Turbo.
3 argyrostomus, L.
3 chrysostomus, L.
2 Cookianus, Chem.
5 funiculosus.
3 margaritaceus, L.
3 marmoreus, L.
3 muricatus, L.
1 Petholatus, L.
2 pica, L.
3 porphyrites, Gmel.
6 radiatus, L.
Turritella
12 cingulata, Sowb.
5 exoleta, Lam.
4 fuscata, Lam.
3 marmorata, Kiener.
7 radula, Kiener.
3 terebra, Lam.
2 torulosa, Kiener.
14 triplicata, Studer.
Unio.
11 æsopus, Gran.
14 alatus, Say.
2 amygdalum.
1 angustatus, Lea.
7 anodontoides, Lea.
2 aqilus, Lea.
4 arctatus, Lea.
1 argenteus, Lea.
1 asperatus, Lea.
4 asperrimus, Lea.

Unio.
? ater, Lea.
1 atrocostatus, Lea.
1 Batavus, Lam.
1 bialatus, Lea.
2 Bigbyensis, Lea.
6 Blandigianus.
1 Boykinianus, Lea.
5 brevideus, Lea.
9 Buckleyi, Lea.
3 capax, Green.
3 capsæformis, Lea.
5 cariosus, Lea.
64 circulus, Lea.
113 clavus, Lam.
106 coccineus, Lea.
3 cœlatus, Con.
2 coeruleus, Lea.
9 complanatus, Soland.
2 confertus, Lea.
2 congarius, Lea.
5 Conradicus, Lea.
4 Cooperianus, Lea.
1 corianus, Lea.
12 cornutus, Barnes.
46 crassidens, Barnes.
25 cylindricus, Say.
1 decisus, Lea.
5 declivus, Say.
117 donacæformis, Lea.
2 Dorfeuillianus, Lea.
4 dromas, Lea.
12 ebenus, Lea.
3 Edgarianus, Lea.
12 elegans, Lea.
36 ellipsus, Lea.
1 Estibrookianus, Lea.
8 fabalis, Lea.
7 Fisherianus, Lea.
3 flavidulus, Lea.
14 foliatus, Hildreth.
8 Formanianus, Lea.
5 fragosus, Con.
10 fuscatus, Lea.
106 gibbosus, Barnes.
6 glans, Lea.
6 gracilis, Barnes.
5 graniferus, Lea.
17 heterodon.
1 Hydianus, Lea.
1 inflatus, Lea.
53 Iris, Lea.
9 irroratus, Lea.
1 Jewitti.
2 Jonesi, Lea.
2 Kirtlandianus, Lea.
22 lacrymosus, Lea.
4 lævissimus, Lea.

Unio.
1 lens, Lea.
1 lenticularis, Lea.
2 lienosus, Conrad.
35 ligamentinus, Lam.
2 littoralis, Drap.
56 luteolus, Lam.
1 medellinus, Lea.
14 Metenevra, Rafinesque.
4 var. Wardii, Lea.
2 micans, Lea.
1 Mississippiensis, Con.
1 modioliformis, Lea.
6 monodontus, Say.
4 multiplicatus, Lea.
19 multiradiatus, Lea.
4 Nashvillianus, Lea.
9 nasutus, Lam.
2 negatus, Lea.
3 nexus, Say.
1 Nicklinianus, Lea.
2 nigerrimus, Lea.
1 Niloticus, Calli.
3 Novi-Eboraci, Lea.
6 nux, Lea.
1 obesus, Lea.
16 obliquus, Lam.
1 obscurus, Lea.
3 occidens, Lea.
4 ochraceus.
1 olivareus, Lea.
7 orbiculatus, Hildreth.
6 ovatus, Say.
112 parvus, Barnes.
1 perdix, Lea.
40 perplexus, Lea.
7 personatus, Say.
27 phaseolus, Hildreth.
1 Phillipsi, Con.
2 pictorum, Lam.
1 pictus, Lea.
46 plicatus, Lesueur.
2 pliciferus, Lea.
11 pressus, Lea.
1 pulcher, Lea.
1 purpureus, Say.
14 pustulatus, Lea.
8 pustulosus, Lea.
9 pyramidatus, Lea.
4 radiatus, Lam.
20 Rangianus, Lea.
37 rectus, Lam.
14 retusus, Lam.
6 ridibundus.
3 rosaceus, De Kay.
3 rotundatus, Lam.
4 rubellinus, Lea.
59 rubiginosus, Lea.

Unio.
5 Sayii, Tappan.
2 Schoolcraftensis, Lea.
8 securis, Lea.
1 Shepherdianus, Lea.
2 solidus, Lea.
5 Sowerbianus, Lea.
1 sparsus, Lea.
5 spatulatus, Lea.
5 sphæricus, Lea.
1 spinosus, Lea.
2 stabilis, Lea.
5 sublatus, Lea.
1 subovatus, Lea.
11 subrotundus, Lea.
4 subtentus, Say.
10 sulcatus, Lea.
1 Tampicoensis, Lea.
4 Tappanianus.
5 tenuissimus, Lea.
9 trapezoides, Lea.
46 triangularis, Barnes.
1 trigonus, Lea.
5 Troostensis, Lea.
15 tuberculatus, Barnes.
7 undulatus, Barnes.
3 Upsonii, Marsh.
6 varicosus, Lea.
26 ventricosus, Barnes.
3 venustus.
9 verrucosus, Barnes.
1 verus, Lea.

Urosalpinx.
3 cinerea, Stimps.

Valvata.
5 sincera, Say.
30 tricarinata, Say.

Venericardia.
2 borealis, Carp.

Venus.
1 flexuosa.
2 mercenaria, Linn.
1 paphia, L.
3 papilionacea, Lam.
4 Tiaro.
2 verrucosa, Linn.

Vermetus.
5 lumbricalis, Lam.

Vitrina.
1 latissima, Lewis.

Vitrina.
10 limpida, Gould.

Vivipera.
25 contectoides, Binney.
9 Georgiana, Lea.
7 intertexta, Say.
3 sub-purpurea, Say.

Voluta.
1 fulminata, Lam.
1 Junonia, Linn.
6 musica, Linn.
3 porcina, Lam.
1 scapha, Gmel.
3 vespertilio, Linn.
2 var. pellis-serpentis, Lam.

Yoldia.
7 limulata, Wood.
2 thraciformis, Stimp.

Zonites.
25 arboreus, Say.
5 acerra, Lewis.
4 Binneyanus, Morse.
4 capnodes, W. G. B.
3 capsellus, Gould.
3 cellarius, Mull.
2 conspectus, Bland.
3 demissus, Binney.
4 Elliottii, Redfield.
3 exiguus, Stimp.
2 ferreus. Morse.
4 friabilis, W. G. B.
5 fuliginosus, Griff.
15 fulvus, Drap.
12 gularis, Say.
4 indentatus, Say.
15 inornatus, Say.
1 intermedus, Fer.
13 internus, Say.
6 intertextus, Binney.
4 lævigatus, Pfr.
4 lasmodon, Phillips.
15 ligerus, Say.
17 limatulus, Ward.
3 milium, Morse.
6 minusculus, Binney.
10 multidentatus, Binney.
12 nitidus, Mull.
6 placentula, Shutl.
3 significans, Bland.
1 suppressus, Say.
9 viridulus, Menke.

ON THE TRACKS OF INSECTS RESEMBLING THE IMPRESSIONS OF PLANTS,

By M. R. ZEILLER.* Translated from the French, by

JOSEPH F. JAMES,

Custodian Cincinnati Society of Natural History.

IN his important memoir upon "Some Tracks of Invertebrate Animals," M. Nathorst mentions the tracks formed on the surface of clay soil by some animals, "that, immediately under the surface, give rise to cylindrical tubes or tunnels, parallel with the surface." He described principally, a track found by him on a clay road, "and with the same structure as that of Phymatoderma;" the unknown animal that had produced this, "having crawled under the surface of the mud, had forced into relief a great number of little rounded points," which produced a resemblance to those observed in this genus by Schimper, and compared by him to the papilliform excrescences of some *Caulerpa.*†

I have observed during the past summer near Villers-on-the-Sea, the tracks of this same genus, and have been struck with their resemblance to certain impressions of fossil plants. These tracks were found on the bottom of a little pool of water, which was sometimes nearly dry, aud was situated on one of the flat spaces formed on a steep part of the coast by the sliding of the marls of Oxford (marls of Villers). They were produced by an animal that had excavated galleries, .015 m. (6-10 of an inch) in diameter, and sunk to a depth of .005 m. (2-10 of an inch) below the surface, and parallel to it. The clay soil had been elevated into the form of a half cylindical ellipse, the upper surface of which was covered along its whole length with these rounded, blunt points. These sometimes assumed a very regular spiral arrangement, and at others were arranged in two parallel, longitudinal series, separated by a middle ridge. To give more clearly to these tracks the appearance of the impressions of plants, they branch quite frequently; one series of galleries starting out at right angles, sometimes to

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* From the *Bulletin de la Societe Geologique de France*, 3d Series, Vol. XII., p. 676, *et seq.*

† A genus of sea-weeds. [J.]

the right, sometimes to the left, so that they seem to be part of a system. These branches run parallel with one another, sometimes approaching, but never branching further. The greater number are lost among the clusters of plants, horse-tails, and cat-tail flags, which crowd the pond; but others running between, begin clearly and end abruptly.

(M. Zeiller here refers to some figures of some of the fragments of these tracks) which I have preserved by taking away the soil, that, in drying, separated in small pieces, .010m (4-10 of an inch) thick, from the edges, and which, while yet soft and damp, easily left the layer beneath, to which they had scarcely adhered.

Their extent, their strong relief, and the regularity of the points with which these tracks are covered, suggests a comparison with *Phymatoderma*, especially with *P. liasicum;* at the same time it is difficult to forget the analogy which they present to certain impressions of Conifers of the genus *Brachyphyllum*, notably *B. Desnoyersi* (Brgt.), of the oolitic of Mamers and d'Etrochey.

I do not, however, in making this comparison, dream of questioning the vegetable nature of *Brachyphyllum*, though the case admits of a doubt. Nevertheless, I believe, that if we found in a fossil state, an impression bearing a resemblance to the tracks that I have just described, without a good idea of their nature, their resemblance to plants would cause us to place them, according to their greater or less clearness, either with the Coniferæ, closely allied to *Brachyphyllum*, or else with the Algæ, closely allied to *Phymatoderma*.

I have explored in vain, the galleries which cover the bottom of the pond, to discover the animal that has made these hollows; but while the search has so far been fruitless, I have succeeded, by examining the tracks which bear a close resemblance to them, in determining their author with certainty.

These tracks present certain characteristics. The floors of the galleries are composed of transverse ridges, all grouped by fours, to the depth of about .001m (1-40 of an inch); these ridges are like those that would be produced by a comb with four small teeth; are as large at the bottom as they are high, and are sharp pointed at the summit. On the ceilings of these galleries we observe a

regular series of impressions, corresponding to the toothed rim; while they also bear a resemblance to the marks made by the animal when forcing a passage through the soft clay, and so producing the rising on the bottom of the blunt points seen on the exterior. But as we find on the bottom the same tracks that are on the ceiling of the gallery, it is evident that the animal has turned on itself.

The appearance of the ridges on the ceiling of the gallery, as well as their size, remind one at once of the galleries of the mole-cricket. It should not, however, be inferred from this, that I believe these animals to live in the water. This has been brought to my mind very lately, by a letter from our member, M. Schlumberger, who, knowing the locality, remarks, that the ponds of the shelves of Villers are dry, at least, in part, during nearly all the summer, and that it would be urged against my facts, that the mole-crickets must have lived in places around these ponds, and extended their wanderings in search of food. I have, therefore, examined, as well as I could, the nature of the tracks of such animals as ought to live near these galleries. It is not possible to place under the necessary conditions, the living specimens of mole-crickets I have secured. I have, therefore, only experimented with the dead individuals, to see the tracks made by the jagged, comblike hind feet, as they press the earth. I have thus produced the toothlike impressions of the ceiling, left on the edge of the clay, and formed by these same feet, alternately to the right and to the left, just as they were made by the insects whence forcing a passage. I have given these details in full, and will add as a confirmation of them, that I have observed, in two or three parts of the ceilings of the galleries, the linear imprints, very delicate, fine, transverse striæ, identical with those produced by the antennæ of the same insects when resting lightly on the soft clay. It is thus positively to these mole-crickets (*Gryllotalpa vulgaris*), that we can attribute the tracks that I have observed.

I have, till the close, reserved my remarks on the analogy that these tracks present to the impressions of plants. If the ponds of Villers were to be covered by a deposit of sand, there can be no doubt that the more the sand penetrated into the galleries, the deeper the imprint of the mold would be made in the layer of grit;

and it would be accompanied in the marl beneath by a sort of branching stem in relief. This would show on the surface of the mold, the ridges, and the teeth of the edge of the gallery. These ornaments of this particular nature, should put us on our guard and make us cautious about attributing to a vegetable, a mold in a cavity made by the inner face of a layer of grit. But as the gallery may have been previously filled up by clay, and this is possible, it could not leave more than the one side in half relief, covered with blunt points, and we would then, without doubt, find it somewhat difficult to determine its true nature.

THE LITTLE SCREECH OWL (*Scops asio, Linn*).

By John W. Shorten.

Presented by Wm. Hubbell Fisher.

From the beginning of November, 1884, up to this date (February 3, 1885), I have personally examined the fresh bodies of not less than forty-five Little Screech Owls (*Scops asio L.*). All these I have skinned.

The plumage of fully two-thirds of this number was of the kind known as the Red, in contradistinction to that known as the Gray. This fact is interesting in view of the observations made to the east of the Allegheny Mountains, showing that there the Gray variety predominated.*

A remarkable fact in connection with these owls is, that they were, for the most part, taken in this city or its suburbs. Some of them came down through the chimneys into the houses and were captured. My theory is, that the owls sought the chimneys for protection from the weather.

I surmise that these birds were attracted to the city by the English Sparrows (*Passer domesticus L.*), which are found here in great numbers.

In my experience as a taxidermist and ornithologist, I have never met with so many Screech Owls in any winter, as I have between November, 1884, and February, 1885.

* For an interesting article on Dichromatism in the Screech Owl, in Ohio, Kentucky and Indiana, see this Journal, V., pp. 52, 53.

A FEATHERED POLICEMAN.

BY J. WINCHELL FORBES.

Presented by WM. HUBBELL FISHER.

GEESE once saved Rome, but the particular individual here concerned, appeared to find his office in repressing roam-ing propensities in his associates; and the palm for stupidity, so far as he was concerned, must be relegated to some other ornithological diversion, the *Dodo*, perhaps, or the Booby.

Billy, as we called him, could boast of no long line of anserestry, at least he never did, and his history previous to his advent in our neighborhood, in a peddler's wagon, is unknown. The blandishments exerted by a daddy dollar, were powerful enough to effect a change of ownership, and Billy entered upon a new life as a chattel of the writer. The only thing that we at first noticed as peculiar, was his great tameness; he, apparently, being greatly pleased at being picked up and stroked.

It being cold weather, he was placed in the chicken-house with the rest of the fowls, and at once made himself at home, meandering about with the evident desire of cultivating the acquaintance of his new associates, and showing at once a marked preference for certain individuals. In a few days, the weather becoming mild, all were turned loose into an adjoining lot, and then Billy's sagacity began to be manifest.

We had a young Cochin cock that was just beginning to crow, and Billy seemed to consider him as his especial charge. About an hour after their entrance into the vacant lot, my wife was alarmed by a hideous outcry at the back door. On looking out, there stood Billy, flapping his wings, and emitting those ejaculations peculiar to his species. Billy was in trouble, that was very evident, and he most unmistakably gave my wife to understand that she was wanted in the "lot," and led the way in the most vociferous manner. Two of the neighboring roosters had pitched upon ours, and Billy, seeing him unable to cope with such odds, had gone for help. Encouraged by the presence of my wife, he attacked the enemy again, and rescued his friend. Not satisfied

with this, he, with many a thump of his bill and a choice assortment of "cuss words," drove our own rooster back into the chicken-house, out of harm's way.

He appeared to recognize the middle of the lot as a boundary line, and would not allow any trespassing upon the side that he considered his property. Ever on the watch, he would drive off all strangers, and his hints to leave were not of the mild variety. The treatment of our fowls was very different, *herding* them as a dog does cattle, and keeping them within their own precincts when possible, and at night driving them into the hen-house. He appeared to know exactly how many there were, and was not content until he had hunted up and "corralled" the last one. The lot being unfenced, some occasionally strayed into the road, when Billy would become frantic, running to the house for assistance, if he found himself unable to manage them alone.

During the whole of his existence, gander Billy discovered many hidden hens' nests, and never failed to lead us to them, and what was most remarkable as evincing a *human* sagacity, he never objected to a *strange* hen depositing an egg, provided the nest was on our premises; but he would tolerate no *stolen* nests outside of the boundary.

Billy died; perhaps it is more true to say, he was *caused* to die, as the very points that made him peculiar, rendered him also a nuisance, for the air was thick with clamor all day long. The final "straw," however, was the fact that he had taken unto himself a wife in the shape of our best hen, and Billy's speedy removal became necessary, as a matter of hen-preservation. This short history is far from being complete, but it is enough to show that some human individuals would require an increase in brain weight to admit of their being styled "*Geese.*"

REPORT AND OBSERVATIONS ON RELIC FINDS.

By Walter A. Dun, M. D.

It is my purpose to-night to call your attention to the importance of accuracy in observing the surroundings of all relics which are found in all diggings. This is of such importance, that I know you will all permit me the opportunity of consuming a few minutes in its consideration. I am satisfied, in my own mind, that man existed on this continent before our last drift period, reaching back in time, as we are told by astronomers, at least forty thousand years. To my own knowledge, there have been many relics of man taken from wells dug into the drift at a depth of twenty feet and more. Such relics are looked upon as curiosities, pondered over awhile, and finally put on the parlor mantel to be kept, and only seen when a stranger appears. If, by chance, a scientist happens along, and the story is told and the relics produced, there is always sure to be some vagueness of memory or description which allows room for doubt. The seeker after facts asks, How do you know that a previous hole hadn't been dug from the surface by modern inhabitants, such as our Indians or their ancestors? How do you know but that the diggers of the well purposely placed these relics where they were found, in order to excite your curiosity? Human nature is so fond of that which is marvelous, that few can resist the temptation of exciting comment, and, consequently, such questions as the above are very pertinent ones. It is important, in order to fully verify these finds, that you should investigate them at once. As a fact, few of them come to light, except long after they occur; and time here, as elsewhere, casts a shroud of mist about them which obscures their importance and questions their authenticity. All this is eminently proper, because we are looking for the real truth; absolute truth we must have, and substantiate it only by absolute proof, in order to have a basis from which we can appeal to the astronomer for data concerning age, thus settling, in some degree, the antiquity of man. But the importance of observation in such cases does not end here. Specimens should be carefully separated, labeled, and accounts of them reported to some scientific body or journal. To illustrate: Often

we find the following label on a specimen—"From a mound." Now we know that mounds were used as places for burial by inhabitants who came after their builders. We also know that there are those who claim that the Indians, as we knew them, descended from the Mound-builders. How are we to decide upon the truth of such a claim? First, collect facts about both, putting in each series that which belongs there, and laying aside all doubtful ones. Since both races of people used the mounds for burial purposes, anything labeled, "From a mound," means nothing but uncertainty. If, however, proper care is taken in excavating a mound, there are always things which can be classed, "Undoubtedly Mound-builder." After a long time, the collection of such facts will form a basis upon which conclusions can be made and a definite answer given to this indefinite and perplexing question. In this brief introduction, I have tried to point out to you the interest and importance surroundlng some relics; and, although archæology may not be in the line of your special interest and study, still it is of so much importance, that I hope you will never neglect any opportunity of carefully investigating, noting, observing and reporting all finds to which an interest is attached. If this paper succeeds in impressing you with the importance of such an object, it will have accomplished the purpose for which it was written.

To begin with the good work in this connection, I desire to call your attention to a flint arrow-head. It is rather a perfect specimen, of good workmanship, and with beautiful notched barbs. Beyond that, it offers nothing of interest, and is certainly nothing beyond any relic found on the surface, unless it can offer something in its history, which is as follows:—

It was found at Plunwood, my father's farm, in Madison County, Ohio, during one of my visits home, and I immediately investigated the find thoroughly, and can vouch for its history. Madison County is situated near the central part of the State, west of the Scioto River, into which the streams flow which drain the entire county. It is so flat in every part that it is almost as level as a prairie. Here and there the surface rises in low knolls, or dips down into shallow depressions, but seldom varying more than five or ten feet in a mile. Along the streams, which are very sluggish,

the banks rise to the height of thirty or forty feet in some places, forming the only exception to the general character already described. The ground is all of the drift formation, covering great subterranean water-beds, which give rise to many springs, and when tapped by wells furnish an inexhaustible supply of water. All of this is underlaid by the Helderberg limestone, which appears in a limited space in the bed of one small stream and furnishes the only outcrop of stone in the county. When the country was first opened up for settlers, this county became, in springtime, very swampy. All the shallow depressions filled up with water, and the land was considered too flat and low for farming purposes. After the summer these pools dried up, and during the fall the Indians from the higher lands in Champaign and Logan Counties were accustomed to start fires ahead and follow down through this region in their annual journey to the Hocking Valley for salt. These annual hunts in the wake of forest fires, while aiding the Indian, left a barren region behind, and most of the timbers of the forest became stunted and knotty in consequence. This fact gave the name of "The Barrens" to a region which is now one of the most fertile and productive in the whole Scioto Valley. So much has been said in order to point out the fact that there were no regular Indian inhabitants, no villages or populous communities of prehistoric people; and as they were accustomed to use it little, there are almost no relics found on the surface. I know of no region where stone relics are so scarce, and where those found, as a rule, show poorer workmanship. In some of the knolls are gravel, which is sought for in building macadamized roads, and in the gravel banks occasionally are found a few skeletons and a few relics, buried at the depth of a few inches. Nowhere in the State has tile-draining done more good than in Madison County. Year by year the shallow pools have been drained, until now only a few are left. In putting in the tile-drain in such a depression on the farm, the ditchers came on the arrow-head which I show you. The depression in question is almost circular, and is about a quarter of a mile in diameter. My earliest recollection of it was a place filled with water in the spring, and in the summer filled with cat-

tails and sedges or wild grass, and a common resort for rattle-snakes, and consequently to be avoided by children.

One very dry autumn, shortly after the war, it was set on fire, and continued to burn and smolder for a couple of weeks, leaving on top light ashes. This may give you some idea of the carbonaceous character of its bed, which was closely allied to peat. The peaty character extends down to an undetermined depth at the center of the depression, but at the margin tapered to a feather edge, and near the margin of the dish, as I knew it, was four feet and a half thick. Under the black peat lay white marl, extending down a considerable depth. At the bottom of the peat, and lying on the white marl, at the depth of four feet and a half, near the edge of the depression, the arrow-point was found. I believe the explanation of it is simple. In the past, a small lake, with many shells, existed, and formed the marl which made up the white layer at the bottom. In this lake was game, at which some aboriginal inhabitant fired the arrow, and it sank to the bottom of the lake. Time passed, vegetation sprang up, and finally formed the peaty layer four and a half feet thick.

I will not draw any conclusions as to the time thus occupied, neither will I speculate upon its probable age. That will be left to the botanist and geologist. All that is to be said in conclusion is, that the peaty layer spoken of is composed in small part of washings from the low, clayey knolls immediately surrounding the depression, and from which the washings must have been very slow. It is my purpose to report to this Society a number of relic finds, about which some points of interest center, and any one who can and will contribute others, will be conferring a favor.

Mr. L. S. Cotton announced the death of Mr. R. B. Moore, a former President and a Trustee of the Society. On motion, a Committee, consisting of Mr. L. S. Cotton, Dr. R. M. Byrnes and Dr. A. E. Heighway, was appointed to prepare a memorial notice for publication in the JOURNAL.

Mr. Chas. Dury exhibited a specimen of the "Whip-Scorpion," or "Mule-Killer" (*Threyphorus giganteus*) from Florida. He said

that the natives considered a sting from this creature to be certain and speedy death ; but it appears from a recent monograph of the scorpions that this one is the only species destitute of a sting.

Mr. Edward M. Cooper read an extract from "An Account of the Discovery of a Mastodon's Remains in Northborough, Mass." It was found about seven or eight feet below the surface. Nine teeth, numerous pieces of bone belonging to the head, and portions of the tusks were secured.

The following names were proposed for membership :

W. H. Knight, Chas. L. Faber,
Rev. I. F. Stidham, Chas. Schuchert,
E. H. Vaupel.

The name of Mrs. John B. Gibson was presented for honorary membership. It was referred to the Executive Board for action.

The following were elected to regular membership :

Rev. Raphael Benjamin, Sam'l R. Singer,
Geo. B. Twitchell.

The resignation of Florian Giauque was read by the Secretary, and referred to the Treasurer for action.

The following letter was read by the Secretary :

Cincinnati, Ohio, Dec. 5, 1884.

Davis L. James, Esq.,
Secretary Cincinnati Society of Natural History.

Dear Sir :—The Cincinnati Amateur Photographic Club tender a vote of thanks to your Society for their kind compliance with our request to meet once monthly, for the coming six months, in your Society-rooms, 108 Broadway. The Club also extend a cordial invitation to the members of the Cincinnati Society of Natural History to join them in their meetings and discussions.

Very truly yours, John B. Clunet,
Secretary Cincinnati Amateur Photographic Club.

The death of Henry Pearce, and of Andrew Erkenbrecher, two members of the Society, was announced by the Secretary.

The donations for the month, were as follows : from T. H. Wise, "The Young Mineralogist, Vol. I , Nos. 4, 5, 6, 7 ;" from Mrs. S. Burlingame Rankin, "Marianne, and Other Poems ;" from H. M.

Cannon, "Annual Report of the Comptroller of the Currency for 1884;" from J. E. Bruce, Vol. V., "Geological Survey of Ohio;" from C. E. Beecher, "Some Abnormal and Pathologic Forms of Fresh-water Shells from Albany;" from Chief Signal Officer, "*Monthly Weather Review*, Nov., 1884;" from Bureau of Education, "Building for the Children of the South," and "Circular of Information, No. 6, 1884;" from Edward M. Cooper, Specimen of Fossil-wood; from Publishers of Publisher's Weekly, "Library Aids;" from Commissioner of Agriculture, "Agricultural Grasses of the United States;" from N. H. Winchell, First and Twelfth "Annual Reports of Geological and Natural History Survey of Minnesota;" from Smithsonian Institute, "Coues and Prentiss Avifauna Columbiana;" from Chas. Dury, thirty-six species of Lepidoptera, one species Neuroptera; from Dr. W. A. Dun, specimen of Arrow-head.

On the evening of February 6th, Gov. J. D. Cox delivered a lecture upon "Diatoms." He opened by noticing the character and position of Diatoms in the scale of life. They are among the lowest forms of vegetables, and are present in all sorts of places. Their silicious skeletons make up thick strata of rock. They multiply by fission. A full explanation of the structure of the wall of the Diatom was given; the investigations of the lecturer showing that the walls of the Diatoms are pitted, and that an intercellular space exists between the two walls. The remarks were illustrated by a number of magic lantern pictures of broken Diatom shells, which showed the structure accurately.

On February 13th, S. S. Bassler lectured on "Weather Changes: How Caused; How Foreseen." After describing the causes of the change of the seasons, and the winds of the equatorial and temperate regions, the lecturer gave a brief history of weather predictions in the United States. The first work of this kind was in 1869, by Professor Cleveland Abbe, in this city, who, by the aid of the Chamber of Commerce and the Western Union Telegraph Company, prepared predictions of the weather. The Signal Service, at Washington, was organized in 1870, with Professor Abbe at its head. The laws governing the development and progress of storms, were touched upon in a concise manner, and at the close,

some of the audience manifested their interest by gathering round the speaker and asking questions on various topics connected with the weather.

On February 20th, Mr. W. H. Knight lectured on "Meteorites, Shooting Stars, and Comets." "The Rosetta Stone of the Universe is the spectroscope. With its aid we can read the message brought to us by light, proclaiming that the universe is constructed upon the same basis and of the same materials as our own earth." Shooting stars, meteors and meteorites were described at length. The most wonderful of the meteors was that of 1860, which passed over the earth from Green Bay to Long Island. It was estimated to be one thousand feet in diameter, and at its nearest approach to the earth, to be only thirty-nine miles high. The lecturer stated that in no case had he been able to verify accounts of loss of life by the fall of meteorites, although such cases are often reported, and narrow escapes are common. There are four large collections of meteorites in the United States. The largest, that of J. Lawrence Smith, of Louisville, containing nearly five hundred specimens, was sold, a few years before his death, to Harvard University. Sometimes as many as three thousand stones fall in a single shower. Meteorites invariably contain iron, often in combination with nickel. Some are so pure as to be malleable when picked up, and horseshoes have been forged from pieces of them. No new metals have been discovered in these bodies, and twenty-two of the chemical elements have been detected. The largest meteorite mentioned, is in Mexico, and weighs about five thousand pounds. The nearest visit of a meteorite to our city, was in 1877, when one fell at Cynthiana, Kentucky.

On February 27th, Dr. Walter A. Dun lectured on "The Scientific Value of Arctic Explorations." The lecturer, after a general statement of the phenomena of heat and life, more especially in relation to the Arctic regions, entered on the general subject of the value of the results of the various expeditions sent to the North. He did not find their value to either science or traffic to be at all commensurate with the expenditure of life and treasure. Half the amount expended in investigating the resources of southern countries, Mexico, for example, would yield a much larger return. The

motives of Arctic explorations have been those of adventure, as the Norsemen, who were the first investigators of these regions; those for the discovery of the Northwest Passage, the search for the Pole and for Sir John Franklin. The latest is that of the meteorologists, who desire to obtain synchronous observations of the weather from all parts of the world.

The value of the country embraced within the circle of 60° north latitude, is almost nothing. The economic products of the region are confined to furs, a little ivory from Siberia, fish and whale oil. The sketch of the physical character of the country, and its fauna and flora, was illustrated with lantern views and specimens. Man, living under circumstances which surround him in the frozen North, is probably the most interesting subject of investigation. He is a carnivorous animal, for, in the absence of plant life, animals alone supply his wants.

MEETING OF MARCH 3, 1885.

Vice-President Skinner in the Chair; twenty persons present. The following were read, and referred to the Publishing Committee:

NOTES ON FOOD OF RAPTORIAL BIRDS.

By Chas. Dury.

The hawks and owls are popularly regarded as very injurious birds, and always killed when opportunity presents itself. Some of the States offer rewards for scalps of raptorial birds, without any distinction of species. The Legislature of Ohio authorized the commissioners of each county to pay a bounty of 50c. each, for hawk scalps, and hundreds of dollars were expended in this way. Recently, however, I believe, this law was repealed. Several American ornithologists have made observations on the food of our birds, but none so thoroughly as Prof. Forbes, of Illinois, who has dissected hundreds each of several of the most common species, and at all seasons of the year. The result of these observations he has tabulated. This is the only correct way of arriving at the economic value of species of birds.

The food of many species varies much with the season, and it is

rather astonishing that our resident species are enabled to find subsistence during very severe winter weather. I was much interested during the winter of 1883 and 1884, in the visits of some of our familiar species to the very fat body of an Emu, which I had skinned and securely fastened in the limbs of tree near a window in my workshop. This body remained from November to April, and was visited by the following species: crow, blue jay, golden-winged woodpecker, downy woodpecker, blue-bird, white-bellied nut-hatch, tufted titmouse, Carolina titmouse, great Carolina wren, brown tree-creeper, and golden-crested kinglet. All of these fed on it. The jays and Carolina titmice were the most frequent visitors; they would eat their fill about every two or three hours. I have seen several species feeding on it at the same time. The European sparrow and cardinal grosbeak, though they frequented the tree, were not observed to eat any of it. I scored the fat with a knife so they could pull it off easily when frozen. The carcass presented a curious sight when I took it down, being nearly worn out. This year I hung up the body of a fat Grebe, but this did not seem to be as much liked as the Emu, as only a single crow and several jays and titmice have been observed to dine on it. However, birds are not nearly as abundant this season as last, in Avondale. I give in a brief manner the result of the dissection of the bodies of the following species, from my note-book of 1884 and 1885:

RED-SHOULDERED HAWK (*Buteo lineatus*).

Dec. 4, 1884. Male. Filled with grasshoppers. Bird killed near Winton Place.

Nov. 13, 1884. Male. The stomach was filled to distention with grasshoppers (*Caloptenus femer rubrum*).

Dec. 2. Male. Filled with grasshoppers and mice. Several others examined during winter, contained mice.

The remarkable fact here is, that this species feeds on grasshoppers, and can find them as late as Dec. 4th.

BALD EAGLE (*Haliaetus leucocephalus*).

Nov. 10. Young female contained fish.

Jan'y 15. Young (very large) female contained balls of rat-hair.

ROUGH-LEGGED HAWK (*Archibuteo lagopus*).

Jan'y 15. Female. Stomach filled with parts of four large field mice.

Jan'y 27. Male. Filled with mice.

This is rather a rare bird in this locality.

GREAT HORNED OWL (*Bubo Virginianus*).

Several examined were empty, but the stomach of one male on May 13th, contained a few feathers, a small bunch of hair, and a beetle (*Lachnosterna fusca*).

Nov. 20. Female. Contained a quail.

Nov. 24. Male. Contained part of chicken.

BARRED OWL (*Syrnium nebulosum*).

Nov. 11. This bird contained a partly digested screech owl (*Scops Asio*), feathers, body and feet.

Nov. 30. Male. Contained mice.

Jan'y 16. Female. Contained mice.

Jan'y 16. Male. Stomach contained part of red-bellied woodpecker, including head and bill.

The idea of one owl swallowing another, is a new phase of owl etiquette to me.

SHORT-EARED OWL (*Brachyotis palustris*).

Nov. 9. A male was filled with mice—several others contained mice.

Nov. 11. A female contained two European sparrows, for which service she deserved a better fate than to be shot.

COOPER'S HAWK (*Accipiter Cooperii*).

May 11. Stomach contained young bird.

May 24. Male. Stomach contained partly digested hermit thrush.

Feb. 7. Stomach contained one European sparrow.

BARN OWL (*Strix flammæ*).

Since my paper published in the JOURNAL, Dec., 1883, several others have been taken in this vicinity; in all of them were mice and their remains.

SHARP-SHINNED HAWK (*Accipiter fuscus*).

Jan'y 18. A sharp-shinned hawk, a male, pursued a European sparrow into a store on Third Street, this city, and captured the sparrow inside the store. The door was closed and the hawk secured alive.

SCREECH-OWL (*Scops Asio*).

This species has been unusually abundant; very many have been examined. I enumerate a few of these.

April 10. Male. Filled with insects, mostly beetles.

May 22. Female. Contained beetles.

Oct. 10. Eight owls, in all of which were insects, mostly beetles.

Nov. 8. One owl contained millipedes.

Nov. 24. One owl, male, contained insects.

Dec. 5. One owl contained mice.

Dec. 11. One owl contained mice.

Jan'y 13. One owl contained thirteen large larvæ, commonly called cutworms (larvæ of *Agrotis*), and several *millipédes*.

Jan'y 25. One owl contained mice and one European sparrow.

These little owls are very beneficial birds. They seem to feed on insects, in preference to anything else, if they can get them. I have been puzzled to tell, where the owl of January 13th obtained the cutworm larvæ. The bird seemed to be a resident, as its feathers were soiled with black coal soot, commonly seen on the birds that linger long in the vicinity of the city. The raptorial birds are almost always very fat, proving they take good care of themselves.

Note.—Since the reading of this paper, the letter appended has been received. It explains itself:

CIRCLEVILLE, March 5, 1885.

MR. CHARLES DURY:

Dear Sir—I noticed a report in yesterday's *Daily Enquirer*, of a paper read by you before your Society of Natural History, on Rapacious Birds.

Allow me to add some testimony to our much needed knowledge of birds of this class.

For many years I have personally known the value of our large

horned owl, as a "ratter," and will cite one instance in particular as proof.

About eight years ago, one of my men discovered a pair of owlets of the large-horned variety, in an old sycamore stub, near my stables on my farm, and concluded to capture them alive. With some risk to himself, he succeeded in securing them, but not without a regular fight with the old ones, who gave him a few wounds. In the nest where he got the young owls, he noticed several full-grown Norway rats, with their skulls opened, and the brains removed. On descending to the ground, he also noticed the bodies of many rats around the tree, and out of curiosity counted them, and found the bodies of 113 rats, most of them full-grown. They all appeared to simply have had their skulls opened, and the brains removed; and from their undecayed appearance, must all have been captured within the previous week, or ten days.

These young owls were taken to C. R. Goldrudeick, Circleville, reared to full growth, and kept several years. They were fed liberally with scraps of fresh beef and the offal of fowls, and having more feed than they could consume, their domicile became an attraction to rats, which are very numerous about the premises. The owls soon got on to their business, and commenced killing the rats. It was a frequent evening remark made by the proprietor of the grocery where they were kept, "They have got another one." "Got another what?" "Why those owls have just got another rat; I heard them." While apparently asleep, and playing "possum" on their perch, if an unlucky rat crept into their cage, they would pounce down and kill it as quickly as any rat-terrier, and take the brains out only.

On account of their nocturnal habits, from my personal experience and observation, I consider the owl, especially the great-horned owl, a bird of great value to the farmer, especially as a ratter. Yours, O. E. Niles.

At the conclusion of the reading of the paper, Mr. Wm. H. Fisher stated, that at Cumminsville, where a number of large trees had been cut down, quite a number of owls had been found. He corroborated Mr. Dury's statement, that one owl will feed on

another, by an account of a circumstance which had come under his own observation. A screech-owl had escaped from a part of a large cage into another part of the same, where there was a large-horned owl. In the morning, only the remains of some feathers of the screech-owl were to be found in the cage. He described the manner in which an owl swallowed a mouse. The prey was caught in the middle of the body between the mandibles, and immediately jerked round with the head toward the throat, and with a sudden gulp disappeared.

Mr. Dury remarked, that at the Zoölogical Gardens, screech-owls fought with and killed one another. He further stated, that in Clermont County he had dissected a specimen of polecat, whose stomach was filled with grasshoppers. This animal bears the reputation of being a depredator on chickens, and is universally condemned by farmers.

Mr. Wm. Hubbell Fisher read a note from Rev. John G. Black, of Bellaire, Ohio, relative to the finding of wood-thrush in the vicinity of his residence, during the present winter.*

Mr. Dury remarked, that the wood-thrush is so entirely an insectivorous bird, that it did not seem possible that it was a winter resident in Ohio. He considered there must have been a mistake in the identification. He stated, that even in Florida, when the birds arrived, they came from the South, showing that they wintered even farther to the south than Jacksonville.

IN MEMORIAM.

(R. B. Moore.)

The undersigned committee, appointed to prepare a memorial of the life of R. B. Moore, beg leave to report the following:

Richard B. Moore was born near Bethel, Clermont County, O., December 28, 1815, and died at his home in Wyoming, Hamilton County, O., January 25, 1885.

The place of his birth was, at that time, a wilderness; his parents, like many of the pioneers, were in straightened circumstances, and

* Since this Mr. Fisher has received the bird referred to by his correspondent, and finds it to be the Towhee Finch, instead of the Wood Thrush.

the advantages and luxuries of the present day were unknown to him in his early life. At the age of 13, his father's home, with its contents, was destroyed by fire, and he then came with his father to Cincinnati, and by driving a cart, assisted in digging the Miami Canal. In 1832 he learned the trade of brickmaking, and afterward became a contracting bricklayer, his last building being the old post-office, southwest corner of Fourth and Vine; after which, for forty years, he was measurer of stonework, brickwork and plastering. In 1836 he joined the I. O. O. F.; October 24, 1840, he was married to Rebecca Jane Hemphill, who survives him; 1851 to 1858, he represented the old Sixth Ward in the City Council, and afterward represented the old Eighth Ward for many years.

During the war he was an active member of the Sanitary Commission, and made several trips in charge of boats, distributing sanitary supplies. From 1858 to 1879, he was President of the Cincinnati Relief Union. He was one of the first members of the Cincinnati Society of Natural History; was President of the Society in 1878, and was one of the three Trustees of the Society, uninterruptedly, for many years, to the time of his death.

He early developed a remarkable taste for study, and frequently, before he was 13 years of age, walked barefooted, to Richmond and back, a distance of over 10 miles, to borrow a book. During the last 25 years, he devoted much time and study to geology, and the collection of fossils and specimens of natural history, of which he leaves a large cabinet, and also a valuable library of scientific works. During the last five years he gave special attention to the study of astronomical measurements and calculations, which he connected with the measurements of the pyramids of Gizah.

His early privations imbued his whole life with sympathy for the poor and unfortunate; his early necessities inured him to hard labor, and taught him the sure road to success; his business brought him constantly in contact with the laboring classes and the poor, and with their sufferings and misfortunes; united to these, his unbounded enthusiasm and untiring energy made him a most efficient promoter of the interests of the laboring class, and a protector and supporter of the poor and unfortunate. These qualities have received public recognition in his prolonged service in the various

offices he was called upon to fill, and especially in his 21 years' service as President of the Relief Union, during which time thousands were benefited by his labor.

Very respectfully,

L. S. COTTON,
R. M. BYRNES,
A. E. HEIGHWAY.
} Committee.

A CONTINUATION of the Mycologic Flora of the Miami Valley, by A. P. Morgan.—*Polyporei*—was read by title. This paper will appear in the next number of this JOURNAL.

Prof. Jos. F. James called the attention of the members to a set of of Arizona Plants, lately purchased from C. G. Pringle. Also to a donation of fifty-two species of fossils from C. L. Faber. He referred to photographs of Mr. W. H. Edwards and Mr. Isaac Lea, presented by Mr. Chas. Dury, stating, that on March 4th, Mr. Lea would be 93 years old, having been born in 1792. Mr. Lea is celebrated as a writer on conchology, having described over 700 species of Unionidæ, besides many species of Melania and of fossils.

Dr. O. D. Norton made some remarks on the mastodon found at Newburg, N. Y., and now in the Warren Museum, in Boston. The tusk from the lower jaw, found at the time, became separated, and was for a long time kept apart from the skull, but is now in its proper place. One peculiarity about this mastodon was, that two of the ribs, having been once broken, were united during the life of the animal.

In the discussion which followed, many members took part. Dr. W. A. Dun referred to the finding of mastodon remains near Hopeton, Ohio, in a bed of peat. Mr. Cotton referred to the finding of remains in various parts of the city and suburbs, in the alluvium. He stated, that when a well was dug opposite where the Burnet House now stands, there were taken from a depth of fifty-five feet, leaves, twigs, etc., of trees. From the material taken

from this depth there sprang, when spread on the ground, great numbers of mulberry trees. It is supposed the seeds were in the soil in a dormant state, and developed when brought under suitable conditions.

Dr. Norton stated that he had seen remains taken from various localities in this city, showing the former presence of the mastodon in this vicinity. He said that many of the European and Eastern Museums had been supplied with specimens from here, and he was glad that a few could now be retained in the Museum of the Society. Mr. Edw. M. Cooper read an extract from the last report of the State Geologist of Indiana (1884), relative to the Mastodon in the Mississippi Valley.

The following were elected to regular membership:

Wm. H. Knight, Rev. I. F. Stidham, Chas. L. Faber.

On the recommendation of the Executive Board, Mrs. John B. Gibson was elected an honorary member of the Society.

Mr. L. S. Cotton was appointed a committe of one to procure, if possible, a portrait of Mr. Robt. Buchanan, a former life member, and a liberal donator to the Library and Museum.

Mr. Dury spoke of the desirability of procuring portraits of eminent scientific men, for the adornment of the rooms. The matter was referred to the Executive Board for action.

The following were the donations announced for the month:

From Census Bureau, Vol. IX. of Tenth Census, with atlas; from Department of the Interior, Vol. III. U. S. Geol. Sur. of Territories under Hayden; from Hon. John. F. Follett, Report of National Academy of Sciences for 1883, and Vol. II., Memoirs of National Academy of Sciences; from Director of Geol. and Nat. Hist. Sur. of Canada, "Comparative Vocabularies of Indian Tribes of British Columbia," and "Sketch of Physical Geography and Geology of Canada," with map; from Chief Signal Officer, "Monthly Weather Review," Dec., 1884; from Public Museum of Milwaukee, "Second Annual Report," and "Circulars Nos. 1 and 2 of Trustees"; from Dr. Heath, Specimens of Crude Paraffine, and Quartz and Mica; from Wm. Holden, "Palæontology of Ohio," Vol. II., "Smithsonian Institution Reports for 1879 and

1880; "American Naturalist," Vol. I., Reports on Rocky Mt. Locust," for 1877 and 1878–79, "Hagen Monograph of N. Am. Astacidæ," "Monograph of Diptera of N. Am.," "Catalogue of Diptera of N. Am.," "Proceedings of Am. Phil. Soc., Vols. XV. and XVI." "Catalogue of Coleoptera of N. Am.," "Packard on Geometrid Moths," "Record of American Entomology," "Naturalist's Directory, 1878," "Leconte Coleoptera of N. Am.," Part I. and six pamphlets; from Lieut. Thos. L. Casey, Part II. of "Contributions to the Descriptive and Systematic Coleopterology of N. Am.;" from Am. Soc. of Microscopists, Proceedings of Seventh Annual Meeting; from Prof. John Collett, 14th Report of State Geologist, 1884; from Smithsonian Institution, Nos. 31, 32, 33 of "Proc. U. S. Nat. Mus., Vol. VII.;" from Wm. Hubbell Fisher, Eight species of plants for Herbarium; from Chas. L. Faber, Fifty-two species of fossils from Europe, Ohio, Indiana, and Kentucky, specimen *Favistellà stellata*, and 4 specimens of Indian Relics; from Dr. W. A. Dun, 2 Circum-Polar Maps; from U. P. James, section of wood of *Cornus Florida*.

GLYPTOCRINUS BÆRI, MEEK.

A slab of limestone about 12x15 inches, having on its surface fifty specimens of the above named and heretofore considered rare species, is now on exhibition at the rooms of this Society. Many of the specimens are nearly perfect, showing body, arms, fingers, and fimbriæ. In some cases several inches of the stem remain attached to the base. All of the specimens are in bold relief, having been developed with great care by Dr. D. T. Dyche, of Lebanon, Ohio.

This slab is, no doubt, the best group of specimens of this species yet discovered. It was found by Dr. Dyche, in the upper part of the Cincinnati Group, in Warren County, Ohio.

U. P. James.

On March 6th the last of the course of free popular lectures was given by Mr. Charles Dury. It was entitled "An Hour with Birds." He began by defining a bird as a vertebrated animal, with warm blood and feathers, which produces its young from an egg. The affinities between birds and reptiles were referred to, and the probable origin from the reptiles considered. The plumage of birds is one of their greatest charms. When the female is bright colored, the male invariably incubates. The various modes of nest-building were dwelt upon at length, especial reference being made to the Mound Turkeys of Australasia. The birds assemble and build a mound of sticks, leaves and earth from eight to ten feet high. In this mass several females lay their eggs and cover them over, leaving a cup-like depression at the apex. This depression catches the rain, which, passing down into the heap, produces fermentation and forms a natural incubator. Descriptions of the Dinornis, the Apteryx and the Dodo were given. The migrations of birds were referred to, as well as the superstitions connected with them.

BOTANY LECTURES.

At the March meeting of the Executive Board of the Society, it was decided to begin a course of instruction in practical botany under Prof. Joseph F. James. This course will be open to the members and to twenty-five invited teachers of the public schools. It will begin about the middle of April, and continue for ten weeks. The sessions will be held in the rooms of the Society on Saturday mornings from 10.30 to 11.30. The leader of the class will furnish the fresh specimens, which will be analyzed under his instruction. The course will be open to members and the invited teachers *only*, and the instruction is free of charge. Should this course prove successful, others, on different branches of science, will be arranged in the fall.

Vol. VIII. No. 2.

THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

Publishing Committee.

JAMES W. ABERT, WALTER A. DUN,
R. BENJAMIN, WM. H. FISHER,
JOS. F. JAMES.

JULY, 1885.

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CONTENTS.

Calendar of Meetings.

Tuesday, July 7.—Business and Scientific Meeting.
Tuesday, July 21.—Executive Board Meeting.
Tuesday, August 4.—Scientific Meeting.
Tuesday, August 18.—Executive Board Meeting.
Tuesday, September 1.—Scientific Meeting.
Tuesday, September 15.—Executive Board Meeting.

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THE JOURNAL

OF THE

Cincinnati Society of Natural History.

Vol. VIII. Cincinnati, July, 1885. No. 2.

PROCEEDINGS OF THE SOCIETY.

Meeting of *April* 7, 1885.

Vice-President Harper in the chair, and twenty-two members present.

The name of E. S. Comings was proposed for membership.

This being the annual meeting, reports were read, as follows:

The report of the Treasurer, Mr. S. E. Wright, for the year ending April 7, 1885, showed the Society to be in a good condition financially. The following table indicates the receipts and expenditures of each year from 1871 to date.

Receipts and Expenditures, Cincinnati Society of Natural History.

YEAR ENDING	DUES, ETC.	INTEREST.	TOTAL RECEIPTS.	EXPENSES.	SURPLUS.	DEFICIT.
April 1871	160 00	....	160 00	165 17	....	5 17
" 1872	385 00	....	385 00	364 22	20 78	....
" 1873	410 36	21 08	431 44	324 93	106 51	....
" 1874	553 95	21 08	575 03	456 34	118 69	....
" 1875	558 30	26 08	584 38	531 46	52 92	....
" 1876	347 54	45 08	392 62	415 95	....	23 33
" 1877	654 00	42 25	696 25	350 02	346 23	....
" 1878	465 00	474 46	939 46	1460 03	....	520 57
" 1879	567 00	1212 41	1779 41	2219 32	....	439 91
" 1880	633 00	4676 64	5309 64	1825 01	3484 63	....
" 1881	560 42	2761 65	3322 07	3439 37	....	117 30
" 1882	541 50	2980 92	3522 42	3794 93	....	272 51
" 1883	579 20	2704 89	3284 09	3444 78	....	160 69
" 1884	592 52	2474 73	3067 25	2982 52	84 73	....
" 1885	449 09	2414 70	2863 79	2523 30	340 49	....

A committee consisting of Chas. Dury, Edw. M. Cooper and Walter A. Dun, M. D., was appointed to audit the accounts and report.

Note.—The Journal is devoted to the Proceedings of the Society. Business transacted, and papers read, constitute the Proceedings.

The Publishing Committee is not responsible for views expressed by authors of papers.

REPORT OF THE SECRETARY.

CINCINNATI, *April* 6th, 1885.

To the Cincinnati Society of Natural History:

Gentlemen:—As the duties of the Secretary of your Society prescribed in section 3, article ii., of the By-laws, are purely clerical, there is little of interest in his work to report. He has thought it desirable, however, to tabulate two matters within the range of his work, and to present them for your consideration.

The correspondence assigned him by the By-laws has been chiefly conducted by the Custodian. As it has almost exclusively related to the library and the museum, it has been assigned to the officer named, for the reason that his greater familiarity with the wants of the library and needs of the museum seems to make the Custodian the proper person to conduct the correspondence. The donations have been acknowledged by the Secretary upon blanks filled out by the Custodian from day to day as material has been received. These acknowledgments have been quite numerous, but as no separate record of them has been kept, numbers can not be stated. The donation-book, however, will furnish this information to any one curious upon the subject.

Members have been notified of the meetings by postal cards, mailed on the Saturday preceding each meeting; about 110 have been sent out each month. The custom of inviting guests and representatives of the press has been observed, and no meeting has passed without a notable attendance of non-members.

The Society has held eleven meetings during the year, against nine the preceding year. The only meeting failing a quorum was that of January, 1885. On that occasion a number of invited guests were present; the paper announced for the evening was read informally, and an interesting discussion followed. The attendance for the year has been as follows.

Attendance of Members, 1884–85.

April, 28.	May, 15.	June, 16.	July, 16.
August, 10.	September, 11.	October, 11.	November, 11.
December, 12.	January, 7.	February, 12.	March, 16.

Or an average of $13\frac{9}{10}$ for the twelve months, or for the eleven actual meetings, $14\frac{4}{11}$.

Comparative statement of the average attendance as shown by the minute-book from 1880 to 1885. (No record of attendance previous to the adoption of the new Constitution in 1880).

1880–81,	Average of seven meetings, no record for five meetings,	18
1881–82,	11 meetings,	$15\frac{11}{12}$.
1882–83,	12 meetings,	$15\frac{3}{12}$.
1883–84,	8 meetings,	12
1884–85,	11 meetings,	$13\frac{9}{12}$.

The averages are taken for twelve full meetings. If taken for the actual meetings, they would be higher.

The Secretary would suggest that the custom of publishing papers in the JOURNAL without first submitting them to the Society, even by title, is probably the cause of the great falling off of the average attendance during the year of 1883–84. Since that abuse has been corrected, and authors are required to place their papers before the Society, the average attendance has increased.

Twenty papers have been read to the Society during the past year.

Ten persons have been notified of their election during the year just past. The following table shows the number of members elected from 1880 to 1885.

1880–81, 13.	1881–82, 10.	1882–83, 16.
1883–83, 10.		1884–85, 10.

The above only shows the elections. The members perfecting membership by payment of initiation and dues are not recorded by the Secretary.

The preparation of abstracts of the proceedings for the daily papers, in the absence of reporters, has devolved upon the Secretary, and he takes pleasure in stating that they have almost always been published. That they have served to keep the Society before the public, may be confidently stated.

Two amendments to the By-laws have been made, as follows:

To section 1, article vi., By-laws, amended by adding these words,

"And all papers shall, before being so published, be read at a meeting of the Society, either in full, by abstract, or by title."

Adopted April, 1884.

To section 1, acticle vi., as amended:

"And a non-member shall not be allowed to read a paper before this Society, unless especially invited to do so by the Society or the Executive Board."

Adopted May, 1884.

All of which is respectfully submitted.

DAVIS L. JAMES, *Secretary.*

REPORT OF THE CUSTODIAN FOR THE YEAR ENDING APRIL 7, 1885.

To the President and Members of the Cincinnati Society of Natural History:

Your Custodian begs leave to make the following report for the year just closed.

The several curators have, in their reports, enumerated the number of specimens added in their respective departments during the year. With a few exceptions these specimens have been placed in the general collection, and have been catalogued. The same method of cataloguing has been continued as that mentioned in my last report; namely, that of entering in an accession list, such specimens as have been placed in the museum. This method, though it entails considerable work, is perhaps the best that can be devised. A catalogue arranged in alphabetical order is inconvenient, because it does not allow additions to be readily made. But when a general list is kept, in which all specimens are numbered, and where all facts regarding them are recorded, the number on the specimen, be it 25 or 3,756, refers to the list, where its character, the locality from whence it has come, and the name of the donor or the source from which it was derived, can all be readily found. So, too, if from any cause the label is lost, or misplaced, a reference to the numbered list tells where the specimen belongs and what it is. This sort of a list, however, does not do away with the necessity for a card catalogue, because it is by means of this last, which serves as an index to any department, that can be ascertained at a moment's notice, whether or not a certain species is to be found in the Society's collection.

The work of cataloguing the general collection has been con-

tinued steadily during the year. It is a great labor and takes considerable time to label and arrange and catalogue a large number of specimens already on hand, and at the same time keep track of the new ones being constantly received. The accession catalogue has been used to record the specimens already in the collection, as it was considered better to have all together than in several separate lists. The catalogue of the Mollusca presented to the Society in February, and printed in the April number of the JOURNAL, is the first installment of the general catalogue. The plan upon which this is based will be continued until all the specimens have been recorded. When completed, it will probably be best to have the separate parts bound together, and, with a few remarks on certain specimens, make it serve as a sort of a guide to the museum.

Although the number of specimens added during the year, is not as great as has been the case in former years, enough have been received to force several facts upon the members. The truth is, that the collection of the Society has now become so large that it is a question of room for its display. Even now there are many specimens packed away waiting for case-room, and the time must soon come when the demand for more room and a new building will be imperative. This is a matter which should be borne in mind by the members and friends of the Society. It must not be forgotten that the usefulness of a collection to the general public, as well as to the student, becomes greater the more adequately it is displayed. Not that it is necessary to have an immense amount of material exposed, but that that which *is* shown should be shown in the best manner. Some one has said that a museum is a collection of labels illustrated by specimens. Labels occupy space, and where this is limited they are liable to suffer.

It is a matter of considerable difficulty to label specimens in a Natural History Museum. Probably the best way and the one which will occupy the least space and at the same time be the plainest, is by means of printed labels; but without either a printing press, or by the expenditure of considerable sums of money, and the Society has neither the press nor the money, printed labels are out of the question. Written ones are the most available, and when the specimen is small, and the name long, there is danger of

either making the label too small, and so being indistinguishable at any distance, or else of getting it too large and so taking up too much room. The use of glass labels, upon which the name of the specimen is either etched, or written with white paint, has been tried to a limited extent and seems very satisfactory, but it does not seem practicable in all cases. When, therefore, the increase of a collection is hampered by want of space, one of two things must be done. Either the specimens must be so crowded that they can not be seen to advantage, or else a smaller number of specimens must be shown for the general public, and the balance placed where they can be examined by only those specially interested. For example: it is extremely desirable that a series of birds, showing the characteristics of the several orders and families, be mounted in a natural manner for the purposes of display; but the larger number of specimens should be kept simply as skins, and in closed cabinets, where they can be comparatively easily kept free from those pests of all museums, the dermestes. So again with animals. A few should be mounted, as many in fact as room can be found for, but duplicate or varietal forms should be stowed away and kept as skins for the purpose of study only. Precisely the same can be said of shells and fossils. One or two of a kind serve the same purpose for display as a thousand. A closed case with drawers, which slip in and out easily, serves the student; in fact, are of more use to him than large display cases. To study a fossil or a shell, or any small object, it is necessary to take it in the hand and see it on all sides and at all angles. This can be done with specimens in drawers; but it is simply impossible in the event of their being placed in exhibition cases. I would recommend, therefore, that space be given to the display of a few attractive objects, and that the bulk of the collections be placed in cases accessible on application by special students. By so doing, space will be utilized which is now useless, and a far better use can be made of that space which is available.

It is gratifying to say that the collections have been extensively used by the pupils of the public schools. But it is with regret that I have to state that too often the only use to which these visitors (one can hardly call them students) put the collection, is to name a certain number of specimens which they are required to have.

How much knowledge is acquired by the copying of names of which every letter must be separately inspected before it can be written, these copyists alone can say, but it certainly seems to be but little. Undoubtedly some of the gatherers of fragments are able to tell something more than the name of their specimens, and all such should be credited with a desire to learn; too often, however, the matter stops when the specimen's name has been secured, and then it reposes in quiet and dust on some shelf in an obscure corner, till thrown away as rubbish, or until resurrected to again form part of the collection of some future aspirant for High School honors. The number of visitors has not been great during the year, an average of about one dozen or so a day, but there is an increase over last year, and all the signs of a steady growth and an additional interest on the part of the citizens as they come to know more and more of the existence of the Society.

The Course of Free Lectures which was given this year has been as successful as in former years, although bad weather prevented as good an attendance as would have been gratifying. The following are the names of the lecturers, and the titles of their several lectures:

Prof. W. L. Dudley, "Water Crystallization."

Dr. W. A. Dun, "A Series of Magic Lantern Pictures."

Prof. John W. Hall, Jr., "Gems and Minerals."

Col. J. W. Abert, "Nature in Art."

Prof. Jos. F. James, "The Ancient Vegetation of the Earth."

Gov. J. D. Cox, "Diatoms."

Mr. S. S. Bassler, "Weather Changes; How Caused, How Foreseen."

Mr. W. H. Knight, "Meteorites, Shooting Stars and Comets."

Dr. W. A. Dun, "Scientific Value of Arctic Expeditions."

Mr. Chas. Dury, "An Hour with Birds."

There can be but little question that the lectures of the character of those given by this Society during the past three years are important features of its work. They have served and will serve to bring the Society before the public, and enlighten them in regard to what is going on in their midst. The attention the lectures attract could be made even more widely extended than it is, and it would

result in still greater benefits. If, also, they could be supplemented by more special courses during the summer, spring or fall, it would be still more useful. At the March meeting of the Executive Board, it was decided to have a course of instruction in Practical Botany, for the benefit of the teachers in the public schools, and thus try and get them interested in Natural Science. The first of these lectures will be given about the middle of the present month (April), and should they prove successful, other subjects will be taken up in the fall and be pursued in the same way.

Since writing the above, the Annual Report of the American Museum of Natural History of New York, has come to hand, and in it are some remarks relative to courses of lectures given by that institution. A department has been created, called the "Department of Public Instruction," and the Superintendent of this Department, Professor Albert S. Bickmore, has arranged a course which is to continue for four years. In the past, these lectures have been so popular and successful, that although the capacity of the lecture room is twice that used at first, there are more applicants than can be admitted, and it is suggested that the room be again enlarged so as to seat *twelve hundred* people. The first course, which began last fall, embraces six lectures on Human Anatomy and Physiology, two on Mineralogy, two on Forestry, and the remaining ten, to be given this spring, on the Animal Kingdom, including such subjects as Oysters and Clams, Crabs and Lobsters, Flies and Mosquitos, Bees and Ants, etc. The second course will embrace ten lectures on Physical Geography, and ten on Zoölogy. The third has three lectures on useful minerals, four on articles of Food, three on Materials for Clothing, five on Birds, and five on Mammals. In the fourth and last course, during the winter of 1887 and 1888, there will be four lectures on Physical Geography, ten on the Races of Mankind, and six on Mammals. All these lectures are so arranged that the same subject is not taken up twice. Their titles, furthermore, are such as to be sure to attract attention. This Society is not yet in a position to give such an extensive series, but something could be done in that direction during the coming year, and it is sincerely hoped some step will be taken in this direction.

The question has been raised lately by some of the members, whether it would not be better to close the rooms during some days of the week and allow the public access on but two or three days. The complaint is, that as matters are now, a member has little advantage over one who is not a member. By opening the rooms on certain stated days, the privilege of visiting them, it is urged, will be considered a greater one than it now is. It has been further suggested, that while the rooms are open to the public on these set days, they should be made accessible on all other days by the presentation of a ticket to be secured from any member. Though it seems desirable that the privileges of the Society should not be cheapened, it is at the same time a question whether we are so overrun with visitors as to make it necessary to exclude them on any day of the week, unless when something special and particular is going on. It is true that the museums in some of the Eastern cities are open only on certain days of the week, but on those days they are visited by great numbers, and it would be a serious disadvantage to students to be interrupted when they desire to study. Other museums, again, charge an admission fee, but this could not be done in our case, as all will acknowledge. At the present time, therefore, it does not seem desirable to close the rooms on any day.

The Microscope which was purchased about a year or so ago, has not been used as much as would be desirable. A donation of ten slides of various sorts of hairs was made by Mr. G. Curtis, and others could be easily secured were the proper endeavors made. The Magic Lantern purchased by the Society, promises to be of great benefit By its means information can be more easily and readily conveyed, and pictures are sure to attract much attention. Mr. C. M. Woodward has donated 24 pictures toward a collection, and these will doubtless come into play frequently. One other addition remains to be noted, as it has not been referred to by any of the curators. That is a specimen of *Pentacrinus decorus*, a recent crinoid, in alcohol, and a gift from Hon. John F. Follett. The fact that a specimen like this can not be taken under the charge of any curator, seems to me an indication of a defect in the constitution. This instrument provides for Curators of Mineralogy,

Palæontology, Conchology, Entomology, Botany, Ichthyology, Ornithology, Anthropology, Comparative Anatomy and Herpetology. It seems a needless multiplication of officers to have so many curators, and amid the multitude to have none to take charge of corals, sponges, or invertebrates of any kind, and to leave the mammals to the tender mercies of the Ornithologist. Why not unite the various branches of Zoölogy under the one Curatorship of Zoölogy? Why not place Mineralogy and Palæontology together? For there would seem the same reason for dividing Botany up into curatorships of Dicotyledons, Monocotyledons, Ferns, Fungi and Algæ, as to divide Zoölogy up into so many little parts.

During the last few weeks your Custodian has been engaged in a new branch of display. The economic side of any science is that which appeals most directly to the utilitarian American. Therefore, when he can see some immediate good to result from the study of science, he is already to give it some assistance. I have been preparing a few cases for exhibition which are to show the products of the insect and plant worlds. Two small cases, 13x13 inches, contain silk-worm cocoons, raw and manufactured silk. Another case of the same size is to have in it a specimen of the cotton plant, and arranged around this as a center will be the seeds, the opened bolls, raw cotton, and the various articles manufactured from this one plant. Other cases could be devoted to the tobacco plant, the flax, and to various food plants. In Entomology cases could be arranged showing the various stages through which injurious insects pass, and giving instructions how to get rid of them. In this way collections could be made of great practical value and use, which otherwise would be objects of curiosity only.

This report may seem more devoted to suggestions of what might be done, than to an account of what has been done. The work must largely speak for itself. Much of the work done, however, is not to be perceived. The clerical labor necessary to keep a constantly-increasing collection of Natural History objects in good order is very great, and the results of this labor only are to be seen. These results are seldom in proportion to the work put upon them. When it comes to the studying of various books to identify and label certain objects, hours could be spent upon a specimen when

all the labor to be observed is the fraction of time taken to write a label. Yet this is the very least of the work, and the easiest part of it. This being the case, then, I have taken upon myself to make certain observations of what *might* be done if the best results are to be obtained from this organization. It only remains to see whether the officers shall see fit to act upon any of these suggestions, or upon those which may have been embodied in the reports of the various curators. All of which is respectfully submitted,

JOSEPH F. JAMES, *Custodian.*

REPORT OF THE LIBRARIAN.

CINCINNATI, O., *April* 6, 1885.

To the Officers and Members of the Cincinnati Society of Natural History:

I have the honor to submit my report to you at your annual meeting. The library during the past year has received many additions, and is now in most excellent condition.

A card catalogue has been completed, and all new books received are at once entered, and without any disarrangement of the previous list, all being in alphabetical order.

A printed catalogue has been ordered by the Executive Board to appear in the JOURNAL from time to time.

There have been added to the library during the year, from December 20, 1883, to December 20, 1884, the following books:

By donations, 98; by exchange, 69; by purchase, 33. Total, 200 volumes and pamphlets.

Many volumes have been received since December 20—the date which ends the above report.

The entire number of bound volumes now in the library is one thousand six hundred and twenty-two. Many pamphlets are not included in the above enumeration.

The books on the library shelves represent an excellent selection, there being few duplicates, and many volumes of great value. The binding is all that could be desired.

During a trip to Washington last spring, the Librarian went to all the different departments, and had the Society either added to or

continued upon their lists for distribution of books, so that we now get all the public documents to which we are entitled.

I regret to state that there are so few book borrowers. During the past year only fourteen persons made use of the library, and only twenty-seven books were taken out. As to the JOURNAL, we have fourteen subscribers and eighty-four exchanges.

The following is a list of the JOURNALS on hand unbound:

Vol. I., seven complete volumes.
" " No. 1, two copies.
" " " 2, five "
" " " 4, six "
Vol. II., six complete volumes.
" " No. 1, 73 copies.
" " " 2, 120 "
" " " 3, 0 "
" " " 4, 90 "
Vol. III., no complete unbound volumes.
" " No. 1, 73 copies
" " " 2, 120 "
" " " 3, 0 "
" " " 4, 90 "
Vol. IV., No. 1, 155 "
" " " 2, 143 "
" " " 3, 222 "
" " " 4, 265 "
Vol. V., No. 1, 221 "
" " " 2, 259 "
" " " 3, 289 "
" " " 4, 289 "
Vol. VI., No. 1, 277 "
" " " 2, 266 "
" " " 3, 287 "
" " " 4, 260 "
Vol. VII., No. 1, 154 "
" " " 2, 335 "
" " " 3, 366 "
" " " 4, 301 "
Vol. VIII., No. 1, not yet distributed.

Very respectfully submitted,

A. E. HEIGHWAY, JR.,
Librarian of Cincinnati Society of Natural History.

REPORT OF CURATOR OF MINERALOGY.

CINCINNATI, *April* 3, 1885.

To the President and Members of the Cincinnati Society of Natural History:

The Society has not received any large accessions to its department of Mineralogy during the past year. Our cases are full and we can not arrange any more specimens until we have more space provided for their reception. In my last report I made a suggestion in regard to making a special collection of rocks, minerals and specimens illustrative of petrology. The Board did not see fit to act upon the suggestion, or at least I never heard from it in reference to the matter. Such special collections are very valuable additions to our Society, for they can be made an object-lesson study for students. When they come to our rooms now they are lost in the *multitude* of forms, and go away with a necessarily vague and confused idea of any department. I proposed, in my last report, and do so again, at the risk of seeming importunate, to have a collection of three cases.

First, "Rocks," which will be so labeled, and have attached to it a manual for reference, so it will illustrate very fully, for any student, the whole subject of lithology.

Second. Another case to contain minerals, typical forms—both crystalline and massive—which will illustrate *that* subject very completely. It will have also an explanatory manual attached.

Third. A case illustrating "Petrology," or a series of rocks especially selected to show ripple-marks, mud-cracks, raindrops, faulting, folding, etc. These cases will contain about 350 specimens, all carefully labeled and *located*, this last being a very important matter to any student of this branch of science. They will cost about $50 only—a very low price for such a valuable addition to our collection.

The following is the list of exchanges and donations received during the past year:

Sixteen specimens by exchange.

Twenty-five specimens, miscellaneous donations.

Also special donations by Col. Abert, Mrs. Eli Kinney and E.

H. Bliss, and a very large collection from the Exposition Commissioners, of minerals and ores.

Most respectfully,

J. W. Hall, Jr.,

Curator of Mineralogy, Cincinnati Society of Natural History.

REPORT OF CURATOR OF PALÆONTOLOGY.

Cincinnati, *April* 7, 1885.

Mr. President and Members Cincinnati Society of Natural History:

In the department of Palæontology I have the honor to report that, during the past year, we have received in exchange 49 species of fossils, have purchased a large mastodon tooth, and have had donations of 120 species, 53 species of which were from Mr. C. L. Faber, a newly-elected member of the Society.

The cases for the display of geological specimens are not at all adapted to the purpose, and have been a cause of serious annoyance to the Custodian for a long time past, and I would urge upon the Executive Board some immediate action looking to the change of cases, as the collection is so valuable that it deserves better display than can now be made.

Respectfully,

Ed. M. Cooper.

REPORT OF CURATOR OF CONCHOLOGY.

Cincinnati, *April* 7, 1885.

Cincinnati Society of Natural History:

The department of Conchology has been somewhat increased during the past year, twenty-one species having been added by donation, and two by exchange. A number of unnamed specimens have been identified and placed in the cases.

A catalogue of all the species in the department has been carefully prepared by the Custodian, and will be published in the next number of the Journal. This was done at the suggestion of the Curator, in order that exchanges might more easily be made, and donations solicited. It was my intention to call with this catalogue upon every member of the Society, and solicit a specimen of every species duplicated in their cases and not already in ours ; also

to ask for some donations from correspondents abroad. It was, however, necessarily a work of time to prepare and publish this catalogue, and the evening for our annual meeting having come, it will remain for my successor to continue the work.

There is a lack of case-room now, and any large additions to the collection could not be accommodated. This matter of additional cases was brought before the Board last year and also the year before, but no action has been taken. This coming year, I hope something may be done, and I feel assured there will be no difficulty in filling all the cases that may be placed at the disposal of the Custodian and Curator.

Our list of books of reference is not remarkably large, and the identification of species is often a matter of great difficulty. Some additions in this department would greatly aid the work. While this branch of science may not be of any more importance than others, or of any greater interest to a scientific student, yet to the mass of the people it is one of the most attractive, and a little judicious expenditure will, I am sure, greatly benefit the Society.

Very respectfully,

MRS. M. C. MOREHEAD, *Curator of Conchology.*

Mr. Chas. Dury, the Curator of Entomology, reported that one hundred and forty-one species, new to the collection, had been received. Also seven specimens of Hornet's nests, etc. He also announced that the room devoted to his department had been neatly fitted up for work and display.

The Curator of Botany, Mrs. Sarah S. James, reported additions as follows:

85 species, herbarium specimens, donated.
310 " " " purchased of C. G. Pringle.
8 species, seeds, donated.
61 wood sections, received in exchange.
2 " " donated.

Also large lot of herbarium specimens from Ohio, Alabama, and Europe, donated by Miss M. Mohr. The section of Botany organized last June, held several large and enthusiastic meetings, but was discontinued, owing to the absence of members from the city.

The Curator of Ornithology and Mammalogy reported the addition of five mounted birds, one skull of the Black Skimmer, two eggs, and fifteen mounted mammals. He also said:

"I am pleased to be able to report that progress has been made in the permanent arrangement of the bird-skins of the collection. Suitable trays have been procured and placed in the drawers, and a part of the skins have been arranged. The skins are in fine condition.

"Donations of birds and mammals to the Society will be highly appreciated. Notes on the migration of birds, their presence, their food, the time when they first appear, when they begin to build their nests—in short, any information on the subject of zoölogy—will be gratefully received, and all authentic matter deemed worthy will be published. Due credit will be given any one furnishing such information. Yours with great respect,

April 5, 1885. WM. HUBBELL FISHER.

The Curator of Ichthyology, Dr. D. S. Young, reported that the collection in his department, consisting of one hundred and sixty alcoholic specimens and twelve stuffed, were in good order. A lamprey eel from Mr. Dury has been received.

REPORT OF THE CURATOR OF ANTHROPOLOGY.

To the President and Members of the Cincinnati Society of Natural History:

Gentlemen:—The department of your museum of which I have had the honor of being Curator for the past year, has been marked by few changes and much inactivity. Whatever was accomplished, was done by the Custodian of the Society, to whose credit it is hereby placed. Twenty specimens of Swiss Lake dweller implements have been received in exchange, and twelve specimens have been donated. Mrs. Eli Kinney donated a lot of arrow-points, and several smaller donations of arrow-points were received. Perhaps the most valuable relic of this department was donated this year by Robert Clarke, Esq., being no less than a mummy.

The basis of this department is the large share of relics received from the Red Bank Cemetery, or the so-called Madisonville find.

The collection of skulls from this locality is very large, and they are in an excellent state of preservation. They offer great inducements for study, when taken in connection with the large number of casts of skulls from various parts of the world, and a careful study of them might reveal some important facts. One often hears that our North American Indians had perfect teeth. Such things are first asserted, and then copied from one author to another, until they are accepted as facts. The series of skulls from the Red Bank Cemetery, on the Little Miami River, throws important light upon such and similar assertions. The study of their teeth, and some comparisons which could be readily made in the department of Anthropology in this Society, would undoubtedly make a very important contribution to the character of those people and their food. While my department has held out tempting subjects like these, time has not allowed me room to accept them. I can but call attention to them, and suggest them to the various members of the Society who may want to work in an interesting direction. The needs of this department are, like those of the associated departments, almost unlimited. Time and space would be wasted in pointing out where our collection could be strengthened, completed for study, or arranged in better order, if there was money enough to do it. While I call your attention to our needs, and will point them out if you are willing and anxious to furnish the money to carry out these new suggestions, yet I think there is one matter so much more important and more pressing than the others, that I venture to make special mention of it here—I refer to the matter of exploration of mounds, and suggest and recommend to the Society, and new Executive Board to make provision to explore a few each year. These monuments of the past races are rapidly fading under the plow, or yielding their hidden secrets to distant societies. The consent of educated farmers to allow these explorations can be easily obtained now. How long this state of affairs will continue, no one can tell. Such explorations could be conducted by the Custodian in connection with your new Curator in this department, and a few hundred dollars annually expended in this direction, would yield immense results in the aggregate in a few years, and at the same time enrich the collection of our

Society with things which are rapidly going to museums outside the State. The entire cost of all Prof. Putnam's explorations about here is slightly over $3,000, although they have lasted over a period of several years. With this one recommendation to the Society, viz: to begin to explore the mounds in this vicinity, before it is too late, this report is most respectfully submitted.

WALTER A. DUN, *Curator.*

The Curator of Herpetology, A. E. Heighway, Jr., reported the collection in his department in good condition, with an addition of six specimens during the year.

The various reports were referred to the Executive Board for action.

The election of officers for the ensuing year was then held, with with the following result:

President, Prof. Geo. W. Harper.
First Vice-President, Col. James W. Abert.
Second Vice-President, J. Ralston Skinner.
Secretary, Davis L. James.
Treasurer, S. E. Wright.
Librarian, Prof. Jos. F. James.

Curators:

Mineralogy, Col. James W. Abert.
Palæontology, Chas. L. Faber.
Conchology, Mrs. M. C. Morehead.
Botany, Miss Nettie Fillmore.
Ichthyology, D. S. Young, M. D.
Comparative Anatomy, O. D. Norton, M. D.
Herpetology, A. E. Heighway, Jr., M. D.
Ornithology and Mammalogy, Chas. Dury.
Anthropology, Reuben H. Warder.

Members at large of the Executive Board:

Walter A. Dun, M. D. — Edw. M. Cooper.
Raphael Benjamin, L.L.D. — O. D. Norton, M. D.

Trustee for two years:

J. H. Hunt, M. D.

[The following was read by title at the meeting of March 3, and laid over till the present time for lack of space.]

THE MYCOLOGIC FLORA OF THE MIAMI VALLEY, OHIO.

By A. P. Morgan.

[*Continued from Vol. VII, p.* 10. *Plate I.*]

Genus II. Polyporus, Fr.

Hymenophore descending in a trama between the pores; the pores hence connate with the substance of the pileus and not separable from each other. Fungi mostly lignatile and persistent.

I. Mesopus.	II. Pleuropus.	III. Merisma.
1. Carnosi.	1. Lenti.	1. Carnosi.
2. Lenti.	2. Suberoso—lignosi.	2. Lenti.
3. Subcoriacei.		3. Caseosi.
		4. Suberosi.

IV. Apus.

A. *Anodermei.*	B. *Placodermei.*	C. *Inodermei.*
1. Carnosi.	4. Suberosi.	7. Stupposi.
2. Lenti.	5. Fomentarii.	8. Coriacei.
3. Spongiosi.	6. Lignosi.	

V. Resupinati.

A. Pores colored. B. Pores white.

I. MESOPUS.

Stipe vertical, simple, concolorous at the base.

I. Carnosi. Pileus fleshy; terrestrial.

1. P. *ovinus*, Fr. Pileus fleshy, fragile, deformed, becoming scaly, whitish. Stipe short, unequal, white. Pores minute, round, equal, white, then citron-colored.

On the ground in woods in autumn; rare. Pileus 2—4 inches broad, fleshy, thick, compact but fragile, very irregular in shape; stipe short and thick, an inch or more in length, sometimes tuberous; edible, with a pleasant amygdaline taste.

2. P. *leucomelas*, Pers. Pileus fleshy, somewhat fragile, de-

formed, silky, scaly, sooty black. Stipe stout, unequal, subtomentose, concolorous. Pores rather large, unequal, cinereous or whitish.

On the ground in woods in autumn: rare. Pileus 2—5 inches broad. Stipe one and one-half inches or more in length. Pileus and stipe here and there changing to black; flesh soft, marbled, pinkish when exposed to the air; pores becoming black in drying; a curious esculent species.

3. P. *flavo-virens*, B. & Rav. Pileus fleshy, tough, subinfundibuliform, more or less irregular, subtomentose, dirty yellow, with obscure zones of greenish-yellow, the margin thin, involute; substance white. Stipe solid, more or less excentric, greenish-yellow. Pores medium, decurrent, angular, irregular, becoming lacerate, whitish, then greenish-yellow.

On the ground in woods in autumn; rare. Pileus 3—5 inches across; stipe one to one and one-half inches long. The pileus is more or less irregular, varying from orbicular to reniform and lobed; the pores are extremely decurrent, extending down the stipe sometimes almost to the base; it is distinguished by its peculiar greenish-yellow color, though the substance inside is white.

II. Lenti. Pileus coriaceous, not zonate; truncigenous.

4. P. *lentus*, Berk. Pileus fleshy, tough, then coriaceous, umbilicate, minutely scaly, pale ochraceous. Stipe short, incurved, hispid and furfuraceous, concolorous. Pores decurrent, irregular, white.

On the dead branches of fallen trees. Pileus 1—2 inches broad; stipe one-half to one inch long. Pileus at first scaly and reddish-brown, at length nearly smooth and ochraceous; stipe covered by the pores nearly to the base; pores large, rather deep, roundish or subquadrate.

5. P. *brumalis*, Pers. Pileus fleshy-tough, then coriaceous, subumbilicate, villous and sooty, becoming glabrous and pale. Stipe slender, hirsute and scaly. Pores oblong and angular, thin, acute, denticulate, white.

On dead trunks and branches, in late autumn and winter. Pileus one to three inches broad; the stipe one to two inches long; there

exists a form with the pores small and round, with thick dissepiments.

6. P. *arcularius*, Batsch. Pileus tough, then leathery, convex, subumbilicate, brown, scaly, then glabrous and yellowish; the margin strigose. Stipe short, somewhat scaly, brown-gray. Pores rhombic-oblong, thin, rather large, entire, whitish.

On dead trunks and branches, common in spring. Pileus one to two inches broad; stipe an inch or less in length; pores whitish or tawny, quite large and elongated, with thin dissepiments, measuring as much as 1.5x.5 mm.

III. Subcoriacei. Pileus hard and dry from the first, then corky or coriaceous; context ferruginous; terrestrial.

7. P. *Montagnei*, Fr. Ferruginous. Pileus corky, soft, deformed, azonate, covered with a seceding scurfy tomentum. Stipe short, unequal. Pores short, ample, round, obtuse, entire, concolorous.

On the ground in woods; rare. This is a larger and more showy species than the others in this section. It is given on the the faith of Berkeley in Lea's Catalogue.

8. P. *parvulus*, Klotsch. Pileus coriaceous, umbilicate, zonate, velvety, cinnamon, then whitish. Stipe short, cinnamon. Pores large, cinnamon, lacerate.

On the ground in woods; rare. Pileus an inch or less in diameter; stipe about half an inch long. This is the *P. connatus*, Schw., of Lea's Catalogue, the pilei being frequently grown together; the two are considered identical by Fries. It is distinguished from the following species by its canescent pileus and the larger pores.

9. P. *subsericeus*. Peck. Pileus coriaceous, subumbilicate, zonate, silky-shining, with close radiating fibers, ferruginous. Stipe slender, tomentose, concolorous. Pores small, angular, short, subconcolorous.

On the ground in woods; rare. Pileus an inch or less in breadth; the stipe half an inch in length. This is the *P. splendens*, Peck, of the 26th Report. My specimens are identical with those received from Prof. Peck. It is distinguished by its thin, silky-striate, shining pileus.

II. PLEUROPUS.

Stipe ascending, simple, excentric or lateral, lignatile.

I. Lenti. Pileus tough-fleshy, azonate; pores short; context pallid.

a. Stipe blackish at the base.

10. P. *radicatus*, Schw. Pileus fleshy-tough, pulvinate, depressed, sooty-pale, subtomentose. Stipe excentric, long, tapering downward, rooting, black below. Pores somewhat decurrent, very large, obtuse, equal, white.

On the ground near old stumps, in autumn; common. I find this plant, as Berkeley says, of various sizes, from the small plant, which Schweinitz describes, to five inches or more across, with the stipe six inches or more in length · the long, tapering stipe penetrates the earth to a depth of several inches, the tip being always attached to some portion of an old root. The pileus is brown or blackish and more or less tomentose; the upper part of the stipe is colored as the pileus, whitish at the top; the lower rooting portion is black and more or less crooked or deformed. The pores are very large, averaging .65 mm. in diameter. *P. Morgani*, Frost, appears to me to be this same plant

11. P. *picipes*, Fr. Pileus fleshy, coriaceous, then rigid, tough, even, glabrous, depressed on the disc or behind. Stipe excentric and lateral, equal, firm, at first velvety, then naked and punctate, black. Pores decurrent, round, small, white, then reddish yellow.

In woods on old logs; common. Very variable in size; pileus very thin but tough, three to six inches or more across, often lobed, the color varying from pale to chestnut, especially on the depressed disk.

12. P. *varius*, Fr. Pileus fleshy-tough, thin, becoming woody, glabrous, subvirgate, deformed, depressed on the disc or behind. Stipe excentric and lateral, even, glabrous, gradually cinereous-blackish downward. Pores decurrent, minute, short, round, unequal, whitish, then cinnamon.

On trunks and branches in woods. The specimens referred to this species are few in number and very variable in appearance; they probably include the *P. fissus*, of Berkeley, together with larger forms.

13. P. *elegans*, Bull. Pileus at first uniformly fleshy, but soon hard and woody, explanate, even, glabrous, of one color. Stipe excentric or lateral, even, glabrous, pallid, the base abruptly black and rooting. Pores plane, minute, subrotund, yellowish white or pallid.

On trunks and branches in woods; rare. Pileus from two to four inches broad, the stipe variable an inch, more or less. The pileus soon becomes hard and woody; it does not thin out toward the margin as in the preceding; the color is a pale ochre or orange, not different on the disk, which is scarcely depressed. The var. *nummularius*, Fr., is smaller, thinner, somewhat regular in outline; the stipe equal, eccentric; the pileus scarcely an inch across.

b. Stipe concolorous at the base.

14. P. *rhipidium*, Berk. Pileus cæspitose, coriaceous, reniform, concentrically sulcate, alutaceous-white. Stipe lateral, short, dilated upward. Pores small, angular, denticulate, whitish.

On old trunks in woods; rare. Pileus one-half to three-fourths of an inch broad; stipe one-fourth of an inch or more in length. This curious species exactly resembles *Panus stypticus*, excepting in the character of the hymenium. It was first described from the Ohio specimens sent by Mr. Lea; it has been found in New York and is common in the Southern States; it has also been found in Ceylon, Brazil and Australia.

II. Suberoso-lignosi, Pileus thick, hard, azonate, stipe stout, vertical, concolorous at the base; pores long.

15. P. *lucidus*, Leys. Pileus corky, then woody, flabelliform, sulcate, rugose, laccate, shining, at first yellow, then reddish chestnut. Stipe lateral, equal, concolorous. Pores determinate, long, minute, white, then cinnamon.

In low, wet places, about the base of trees and stumps; common. Pileus 3—5 inches broad, the stipe variable; as it grows in this region, the stipe is always more or less deformed and often wanting; the pilei, when sessile, are then sometimes imbricated and connate.

III. MERISMA.

Out of a common trunk or tubercle are unfolded numerous

pileoli, which have arisen by divisions of the primary pileus. These are the largest and most showy of all Fungi.

I. CARNOSI. Pileus fleshy, firm, floccose-fibrous, azonate; autumnal.

16. P. *anax*, Berk. Very much branched, fibrous, fleshy, a little tough; pileoli very numerous, recurved and imbricate, fibrous-tomentose, dusky gray; stipes thick and concrescent, white. Pores large, unequal, angular, white. Spores white, subelliptic, .007—.008 mm. long.

At the base of oak trees and stumps in autumn; common. It branches out from a thick, single stem at the base, and forms a large head of branches and pileoli 10 to 20 inches in diameter; the branches terminate in numerous leafy pileoli of various forms and sizes, imbricating, confluent and recurved; the flesh is white, like the pores. The species does not appear to differ from *P. frondosus* Fr., except in the large, irregular pores; both are probably forms of the ancient *Fungus intybaceus*.

II. LENTI. Pileus, fleshy-tough, then coriaceous, more or less zonate, fibrous within; autumnal.

17. P. *giganteus*, Pers. Imbricato-multiplex, fleshy-tough, then subcoriaceous. Pileoli dimidiate, very broad, flaccid, subzonate, rivulose, bright brown, depressed behind. Stipes from a common tuber, connate, ramose. Pores minute, subrotund, pallid, at length lacerate.

On the ground about the base of old stumps; not rare. It forms large tufts, one to two feet or more in breadth, branched in an imbricated manner; pileoli various in form, the surface granulated with minute brown flocci, the disk depressed, at length black; pores dirty brown when bruised.

18. P. *Berkeleyi*, Fr. Imbricato–multiplex, fleshy–tough, becoming hard and corky. Pileoli very large, subzonate, finally tomentose, alutaceous. Stipes short or none, arising from a long and thick common base. Pores rather large, irregular, angular, pale alutaceous.

Growing out of the ground usually near trees or stumps; not uncommon. The pileoli are sometimes nearly a foot in breadth and few in number, or they are smaller and more numerous. A speci-

men before me, consisting of 15 to 20 lobes and pileoli, has a breadth of 15 inches and a heighth of one foot; the common stipe usually penetrates the ground some distance. The original specimen from the herbarium of Berkeley, described by Fries, appears to have been a single large segment or pileolus (Nov. Symb., p. 56). Fries styles it "Nobillissimus interomnes mihi cognitos Polyporos." Miss Banning's *P. Beatiei* seems scarcely different, except in texture.

19. P. *distortus*, Schw. "Pilei confluent, distorted or ear-shaped, cervine, with the pores on all sides; pores minute, rather soft, white, growing pallid." *Schw.*

"Pilei numerous, subdimidiate, distorted, ear-form or orbicular; covered all over by the pores, which are white, becoming pale, minute, sinuate, rather soft, and which often grow upon the margin of the pileus, rendering it thick and porose, and run down on the spongy, coriaceous stipes. Frequently the fungus is found destitute of a pileus, being everywhere porose and club-shaped, or cylindrical." *Fries.*

This polymorphous species I observe not uncommonly growing about the roots of the stumps in newly-cleared lands. I am unable to see that it is an imperfect form of any other species.

III. Caseosi. Pileus cheesy, at first watery–soft, afterward dry and fragile; growing in spring and summer, but short-lived and soon crumbling to pieces.

20. P. *sulphureus*, Bull. Cæspitoso-multiplex, juicy-cheesy, soon growing pale. Pileoli imbricate, undulate, nearly glabrous, reddish-yellow. Pores minute, plane, sulphur-yellow. Spores white. .0058x.0076 mm.

On old logs, stumps and even the decayed portions of standing trees; very common. Forming large tufts, 1—2 feet or more in breadth; pileoli various in form, but in their fresh state readily distinguished by the sulphur-colored pores, though the bright colors are soon gone, and the whole pales out and crumbles to pieces.

21. P. *Cincinnatus*, Morg. Consisting of numerous caespitose-connate, imbricated, more or less stipitate pileoli. Pileoli very broad, reniform, undulate and rugose, nearly glabrous, reddish-

yellow, subzonate toward the margin. Pores minute, unequal, somewhat angular, milky-white. Spores white .0037x.0055 mm.

Growing on the ground about the base of trees in damp woods. The whole mass is four to six inches in height, spreading upward and outward all around, with numerous pileoli symmetrically disposed, to a diameter of 12 to 16 inches across the upper surface. The common stipe rests bluntly on the ground, scarcely rooting. The single pileoli are 3—8 inches broad, with an extent of 2—5 inches, each stipe an inch or less in length; the thickness about one-half an inch, thinning out to the edge.

IV. SUBEROSI. Pileus corky or coriaceous, persistent, tenacious; texture floccose, fomentarious; truncigenous.

22. P. *graveolens*, Schw. Corky or woody and extremely hard, very closely imbricated and connate, forming a subglobose or polycephalous mass. Pileoli innumerable, inflexed and appressed, plicate, brown. Pores concealed, very minute, round, pale brown; the dissepiments thick and obtuse.

In woods, on old dead trunks; not uncommon. This remarkable fungus consists of innumerable pileoli, forming a subglobose or elongated mass 3—6 inches in diameter, and often many inches in length, especially on standing trunks. When fresh and growing it has a varnished or resinous appearance, and often purplish or reddish tints, with a paler margin. The substance within is ferruginous, rather soft and floccose, but covered by a very hard brown crust. The pores are brown, but lined with an extremely minute white pubescence. The pileoli are so closely imbricated and appressed as almost or entirely to conceal the pores. I am unable to separate from this the *P. conglobatus* of Berkeley; this latter Fries states to be a species of Trametes (Nov. Symb., p. 67), while he refers *P. graveolens* to the Merismoidei, l. c. p. 62. It is called by people "Sweet Knot," but I am unable to verify the popular notion concerning its wonderful fragrance, perceptible at a great distance from the tree on which it grows. When fresh, it has a strong and disagreeable odor, as described by Schweinitz.

IV. APUS.

Pileus sessile, adnate, dimidiate; lignatile.

A. ANODERMEI. Pileus at first more or less fleshy and watery or juicy, without a distinct cuticle.

I. Carnosi. Pileus cheesy, at first watery-soft, fragile, flocculose; pores white.

23. P. *lacteus,* Fr. White. Pileus fleshy-fibrous, fragile, triquetrous, pubescent, azonate; the margin inflexed, acute. Pores thin, acute, dentate, at length labyrinthiform and lacerate.

In woods, on trunks, especially of beech. Commonly small and thin, about an inch in width, but sometimes transversely elongated; steep and gibbous behind, becoming at length smooth and unequal.

24. P. *fragilis,* Fr. Whitish, brown spotted to the touch. Pileus fleshy-fibrous, fragile, plano-depressed and reniform, rugose, convex beneath. Pores thin, long and flexuous, intricate.

In woods, on very rotten wood; rare. Pileus 2—3 inches in breadth, projecting an inch or more, and about an inch in thickness. The specimens so referred were at first white and very fragile; in handling and drying they have become brown and brittle.

25. P. *cæsius,* Schrad. White, here and there with a bluish tinge. Pileus fleshy, soft, tenacious, unequal, silky. Pores small, unequal, long and flexuous, dentate, lacerate.

In woods, on sticks; rare. Pileus ¾—1½ inches broad and long, simple or subimbricate, sometimes sub-stipitate. The color assumed by my specimens is a bluish-gray. The pores are rather small and become toothed and lacerate.

26. P. *delectans,* Peck. White, becoming yellowish. Pileus fleshy-fibrous, firm, simple or subimbricate, azonate, subtomentose. Pores large, unequal, at first subrotund and obtuse, then thin, angular and dentate. (Plate 1.)

In woods, on fallen trunks; common. Pileus two to four inches in breadth, with a projection of one to two inches, or, confluently, several inches in width. The stratum of pores is about half the thickness of the pileus.

27. P. *destructor,* Schrad. Pileus watery-fleshy, effuso-reflexed, fragile, rugose, subundulate, brownish-whitish, zonate within. Pores long, roundish, dentate or lacerate, white.

On old logs; rare. My specimens so referred are 3—5 inches in width and project about an inch. But it is said to be extremely variable in form, being often wholly resupinate. The *P. hybridus*, Sow., or "dry rot" of ships built of British oak, is thought to be but a form of this species.

II. Lenti. Pileus fleshy, tough, soft, elastic, villous-tomentose; pores colored.

28. P. *nidulans*, Fr. Pileus fleshy, very soft, subpulvinate, villous, then smooth, azonate, reddish-gray, of the same color within. Pores long, medium, unequal, angular, tawny-reddish.

On fallen trunks and branches, especially of hickory. Pileus 1½—3 inches in breadth. Readily distinguished by its peculiar softness and color.

29. P. *fumosus*, Pers. Pileus fleshy, corky, firm, azonate, silky, becoming glabrous, sooty-pallid, dilated-adnate behind; within, fibrous and subzonate. Pores minute, short, round, entire, whitish-smoky, darker when rubbed.

On stumps, near the ground, especially of willow. Cæspitose and imbricated, the pileus attaining a breadth of 3–4 inches, the smoky tint more or less prevalent, larger and smoother than the next.

30. P. *adustus*, Willd. Pileus fleshy-tough, thin, villous, cinereous-pallid, effuso-reflexed behind. Pores minute, short, round, obtuse, whitish, pruinose, soon cinereous-brown, the marginal ones obsolete.

This is one of the commonest of Polypori, and is found on trunks of every kind. The typical form, *villous*, and with the margin *straight*, is seldom met with; a form velvety, isabelline in color, thin and coriaceous when dry, like *P. isabellinus*, Schw., is common; the pileus is sometimes subzonate toward the margin; it occurs with the margin undulate, rugulose and even crisp; but in all the forms, the minute burnt brown pores prevail. *P. fumoso-griseus*, C. & E., is a resupinate form of this species growing on butternut.

31. P. *dichrous*, Fr. Pileus fleshy-tough, thin, soft, effuso-reflexed, even, silky, white. Pores short, minute, round, obtuse, brown-cinnamon.

On trunks of all kinds; common. Pileus an inch or two in breadth, and projecting an inch or less, but often effused and laterally confluent to the extent of several inches. A beautiful species. The hymenium is waxy, whence it has given rise to another genus, *Glœoporus conchoides*, Mont. The hymenium varies in color, being oftener a *pale cinnamon* in this region; occasionally I find a specimen with the dark purplish pores and narrow ferruginous margin of *P. nigro-purpurascens*, Schw.

32. P. *nivosus*, Berk. Pileus fleshy, tough, moderately thick, effuso-reflexed, laterally confluent, azonate, glabrous, snowy white. Pores minute, angular, acute, entire, whitish.

In woods on fallen sticks and branches; rare. Pileus ¾—1½ inches in breadth, more or less imbricated, and often laterally confluent, always extensively effused and sometimes wlth a very narrow reflexed margin; the pores are very small and angular; the color of the fresh and growing specimen is snow white, but in drying, it takes on an alutaceous hue, sometimes with greenish or brownish discolored spots. My specimens are identical with specimens of the species received from Mr. J. B. Ellis, of New Jersey. I am indebted to Mr. W. C. Stevenson, of the Philadelphia Academy of Sciences, for a copy of the original description.

III. Spongiosi. Pileus at first wet and spongy, when dry, firm and elastic (or hardened), fibrous within.

a. Context Colored.

33. P. *endocrocinus*, Berk. Pileus large, thick, spongy-fibrous, strigose–bristly, dark brown, the substance within of a rich saffron. Pores medium, thin, angular, lacerate, golden brown.

On decayed spots in standing trunks of hickory. Pileus, 3—6 inches in breadth. The few specimens I have met with were much deformed; but I judge it belongs here in the place where Fries assigns it, Nov. Symb., p. 55. I do not find any stipe.

34. P. *Pilotæ*, Schw. Crimson orange. Pileus very large, pulvinate or subungulate, nearly glabrous, spongy, fibrous, becoming hard and corky; the substance within uneven, zonate. Pores long, medium, at first round and thick, then thin and angular.

In woods on old logs; rare. Pileus 4—6 inches, or sometimes

nearly a foot in diameter. The color of the specimens varies greatly with the age; they are at first, and when perfectly fresh, of a gorgeous crimson-orange; then the surface of the pileus grows paler through orange to alutaceous; and the hymenium grows darker through brownish crimson to dark brown; the substance varies to reddish and pale wood-color, and is remarkably zonate. This is the *P. hypococcinus* of Berkeley, in Lea's Catalogue, according to Fries in the Novæ Symbolæ. Schweinitz seems to have found it but once, and his specimens had evidently lost their brilliancy; while Mr. Berkeley's description is based upon the notes and careful observations of Mr. Lea. This is certainly one of the most magnificent of fungi, both in size and color.

35. P. *cuticularis*, Bull. Pileus thin, spongy, fleshy, then dry, applanate, hirsute and tomentose, rusty brown, becoming blackish; within loosely parallel-fibrous; the margin fibrous-fimbriate, incurved. Pores minute, long, pallid, then ferruginous.

In woods on old trunks; common. Pileus 2—4 inches in diameter and rather thin. More or less imbricated and concrescent, obsoletely zonate, unequal and somewhat triangular, inflexed when dry; the tomentum strigose or velvety. Pores in the fresh specimens cinereous, pruinose, glittering when turned in the light. Spores very abundant, Indian yellow, .0056 mm. in length.

b. Context White.

36. P. *galactinus*, Berk. White. Pileus simple or subimbricate, spongy-fleshy, soft, becoming hardened, strigose-tomentose, zonate within; the margin incurved. Pores minute, round, entire.

In woods on rotten logs; common. Pileus 2—4 inches in width, somewhat pulvinate, thick, and sometimes gibbous behind, at first fleshy, soft and fragile, but drying quite hard, the margin curving inward; the color is commonly a milky white, but sometimes this is modified by sordid or smoky tints. The pores in the fresh plant are extremely minute, with thick dissepiments, and the hymenium has a silky luster; in the dried specimens they appear larger, thin, and somewhat angular, but always entire. There is little if any difference between this and *P. undulatus*, Schw.

37. P. *pubescens*, Schum. Pileus fleshy-tough, then corky, soft,

convex, subzonate, pubescent, white within and without; the margin acute, at length yellowish Pores short, minute, nearly round and plane.

On stumps and old trunks; not common. Pileus 1½ inches or more in breadth, usually much imbricated and laterally confluent. My specimens differ in color from the type, being rather brownish, especially on the margin; they may be the *P. Sullivantii*, Mont., which Prof. Peck considers as not specifically distinct.

B. *PLACODERMEI.* Pileus covered with a contiguous crust, azonate or concentrically sulcate; persistent.

IV. Suberosi. Pileus at first somewhat fleshy and juicy, afterward hardened, covered by a rather thin crust; autumnal and somewhat persistent.

38. P. *dryophilus*, Berk. Pileus large, thick, ungulate, fleshy, then corky, uneven, scabrous, ferruginous-yellow, canescent. Pores small, irregular, angular, entire, ferruginous, the mouth whitish.

Growing at the base of living oak trees, and also on oak logs. Pileus 3—5 inches in breadth, 1½—2 inches thick. The pileus is commonly very irregular and unequal, the surface uneven, with elevations and depressions; the ferruginous color prevails throughout, whitened externally by a subtle canescence or glaucescence. It is rather corky from the first, becoming hard and brittle.

39. P. *resinosus*, Schrad. Pileus fleshy, then corky, flocculose-pruinate, reddish brown; the cuticle adnate, rigid, rivulose, resinaceous; within azonate, pallid. Pores minute, equal, pallid.

On old trunks in autumn; very common. Pileus usually 4—7 inches in breadth, though specimens a foot in diameter are met with; often imbricate and sometimes zonate.

V. Fomentarii. Pileus dry, covered with a hard, horny crust; perennial, yearly adding new strata.

a. Context Colored.

40. P. *reniformis*, Morg. Pileus sessile or substipitate, reniform or dimidiate, ascending, concave above and convex below; the surface ferruginous, concentrically sulcate and subzonate; the margin thin and acute. Pores minute, ferruginous, the mouth whitish.

Growing about the base of old stumps; common. Pileus 3—6

inches in breadth, and about 1 inch thick at the base. This species seldom makes but the growth of a single year; when more than one year's growth is made, a new stratum of hymenophore is interposed between the successive strata of tubules as in *P. vegetus*, Fr.

41. P. *applanatus*, Pers. Pileus horizontal, explanate, obsoletely zonate, pulverulent or glabrous, cinnamon then canescent; the cuticle crustaceous, rigid, at length fragile; within very soft, loosely floccose; the margin tumid, white then cinnamon. Pores minute, subferruginous; the mouth whitish, changing to brownish when rubbed.

On old stumps and logs; very common. Pileus from 4 or 5 inches to 1 foot in diameter, and 1 to 2 inches in thickness, flattened out and not at all ungulate, as in the next species. The pores are distinctly stratified, and it often occurs with a growth of several years.

42. P. *fomentarius*, Linn. Pileus ungulate-pulvinate, thick, glabrous, remotely concentrically sulcate, opaque, sooty, then canescent; within soft, floccose, ferruginous-tawny; cuticle thick, very hard, persistent; the margin glaucous-pruinose. Pores very long, minute, distinctly stratified, at first glaucous-pruinose, afterward ferruginous.

This species is common in the Eastern States on trunks of beech and birch; in this region it must be extremely rare, as I never met with a specimen, though it is in Lea's Catalogue. Pileus 3—5 inches in width, and 2—3 inches high, in shape much like a horse's hoof. The cuticle is very hard, brownish gray, with cinerous and dark zones; the margin generally rather acute, and the surface of the pores concave; the substance within spongy, tawny, yielding the best of amadou. The pores are distinctly stratified and at first are whitish, glaucous or yellowish-gray, at length ferruginous. It differs decidedly in form from the preceding species, with which it was once included.

43. P. *rimosus*, Berk. Pileus pulvinate-ungulate, much dilated, deeply concentrically sulcate, cinnamon, then brown or blackish and exceedingly rimose; context very hard, fibrous-radiating, tawny-ferruginous; the margin broad, pruinate-velvety, rather

acute. Pores minute, indistinctly stratified, tawny-ferruginous, the mouths rhubarb color.

On decayed spots of the trunks and branches of the living trees of the common locust (Robinia); common. Pileus from 3 or 4 inches to a foot in diameter, and 2 inches or more in thickness. The annual increments are distinguished by the deep concentric furrows on the upper surface, rather than by distinct strata of pores; the marginal band is of the same rhubarb color as the pores, while the older bands become cracked and brown or blackish. This is a most elegant Polyporus; the species was founded on specimens from New Holland, and it has been found in South Africa. How far eastward it extends, I am unable to say, but should judge that it ranged with the Robinia. I am disposed to think it is the *P. igniarius* of Schweinitz, N. A. Fungi. For the identification of the species I am indebted to Dr. M. C. Cooke, of London.

44. P. *salicinus*, Fr. Pileus woody, very hard, undulate, glabrous, the largest part resupinate; the margin short, obtuse, spreading, cinnamon, then canescent. Pores minute, round, ferruginous-cinnamon.

Growing commonly on old logs of the American Ash; often many feet in extent, with the narrow upper margin seldom more than an inch in thickness, and soon becoming brown and blackish. The fresh pores exhibit an elegant satiny luster when turned in the light.

45. P. *supinus*, Fr. Pileus woody, hard, effuso-reflexed, pallid; the margin obtuse; the substance within ferruginous. Pores minute, round, obtuse, cinereous-brown.

On the branches of an old Peach tree. Pileus roundish and mostly effused, an inch or two in diameter, or confluent for several inches on the under side of a branch, half an inch in thickness; the older portions turning blackish. A fine gray tomentum overspreads the surface and the pores, while the context beneath is ferruginous or brownish.

b. Context White.

46. P. *fraxinophilus*, Peck. Pileus subungulate, corky, woody, hard, concentrically sulcate and rimose; the margin obtuse, white;

context stratose, white, then subferruginous. Pores medium, unequal, nearly round, obtuse, white.

On living trees of the White Ash; common. Pileus 3—6 inches or more in breadth, and 2—3 inches thick. The pileus is commonly more or less irregular or deformed ; it is distinctly stratified within and without, both the substance and the pores; the white margin changes to gray or cinereous, and finally to brown and blackish in the succeeding years; the white pores and substance become isabelline, and at length somewhat ferruginous. The pores are very large for this class of Polypori, averaging as much as .35 mm. in diameter ; they are quite trametoid in appearance. It grows high up on the living trunk, on spots where branches have broken off.

47. P. *connatus*, Fr. Pileus corky, woody, effuso-reflexed, scalari-imbricate, concrescent, villous, white or cinereous; the context and pores stratose. Pores minute, nearly round, white.

Growing at the base of Maple trees, between the roots, and often covered over by mosses; common. Pilei 2—5 inches in breadth, and often reflexed 2 or 3 inches. Our specimens are scarcely villous, but velvety, and glabrate; the white changes to an elegant cream color in drying. The dried specimens are light and corky, yet the plant is remarkably persistent, some specimens exhibiting the strata of many years.

VI. Lignosi. Pileus hard and woody, covered by a thin crust, more or less effused at the base ; perennial, but not stratose.

48. P. *fraxineus*, Bull. Pileus corky, woody, glabrous, somewhat applanate, whitish, then reddish and brown, at first even, afterward concentrically sulcate-plicate, pallid within. Pores minute, short, reddish at first, as well as the margin covered with a white sebaceous down.

On trunks of the White Ash ; rare. Pileus 2—4 inches in breadth, or confluently several inches. Solitary or imbricated, rugged, subzonate, dark red-brown ; the margin, substance and pores pale reddish. Odor strong and penetrating.

49. P. *glomeratus*, Peck. Pileus corky, woody, effuso-reflexed, densely imbricate, concrescent, subtomentose, dark tawny, obscurely zonate. Pores small, angular, greenish yellow, with purple tints, the mouths with a silvery sheen.

In woods on old Maple logs; not common. The pilei are often effused to the extent of several feet, with a narrow irregular margin of half an inch or more. Greenish-yellow, olivaceous, and sometimes purplish tints are variously blended; and these likewise affect the substance and the pores.

50. P. *gilvus*, Schw. Pileus corky, woody, hard, effuso-reflexed, imbricate and concrescent, subtomentose, then scabrous and uneven, reddish yellow, then subferruginous, the margin acute. Pores minute, round, entire, brownish-ferruginous.

In woods on fallen trunks and branches; very common. Pileus 2—3 inches in breadth, and projecting 1—1½ inches. The pileus is first thin, of a bright reddish yellow, and velvety or subtomentose; afterward the form and surface is various. The pileus may remain thin, or it may become excessively thickened and subungulate; the surface soon becomes scabrous, and sometimes it is furnished with warty granules; it is often very uneven or scrupose. Specimens occur that are distinctly zonate. The reddish yellow of the growing margin soon changes to ferruginous, and very old specimens have assumed a canescence.

I am of the opinion that *P. gilvus*, Schw., *P. isidioides*, Berk., and *P. scruposus*, Fr., all pertain to the same species, and I am unable to separate them even as varieties; I think they are based on differences in the form and age of the specimens. I do not think it is ever "fleshy-tough" as appears to be assumed by Fries in the Epicrisis.

C. *INODERMEI.* Pileus from the first dry and firm, the cuticle thin and fibrous.

VII. Stuposi. Pileus corky or coriaceous, azonate or the zones not differently colored, glabrate or appressed villous; the context fibrous or floccose.

a. Context Colored.

51. P. *radiatus*, Sow. Pileus corky, coriaceous, rigid, radiately wrinkled; at first velvety, tawny; afterward glabrate, ferruginous-brown; the margin spreading, repand. Pores minute, pallid, silvery-shining, at length ferruginous.

On decayed trunks; rare. Pileus 1—2 inches in breadth, very

much imbricated and concrescent, always corky; the margin repand, radiate-rugose and subzonate.

52. P. *cinnabarinus*, Fr. Pileus corky, pubescent becoming glabrous, scarcely zonate, rugulose, cinnabar-red, expallent. Pores round, medium, entire, of a deeper red than the pileus.

On trunks of all sorts, especially Cherry; common. Pileus 2—4 inches in breadth, convex above and plane beneath. The younger plants and the growing margin are pubescent, the older portion becomes glabrous, and is wrinkled and pitted. It is recognized at once by its elegant color. It is given as a Trametes in the second edition of the *Epicrisis*.

b. Context White.

53. P. *molliusculus*, Berk. Whitish. Pileus corky, thin, radiately wrinkled, zonate, velvety-strigose; the margin often lobed; the context floccose, white. Pores medium, subrotund; then thin, acute and lacerate.

In woods on old trunks; common. Pileus 1½—3 inches in breadth, usually much imbricated, and usually effuso-reflexed; the zones of soft strigae are sometimes a little deeper colored. The dried plants are very light, and of an isabelline or alutaceous hue.

54. P. *fibula*, Fr. Whitish. Pileus coriaceous, soft, tenacious, velvety-hirsute, azonate, often radiate-rugose; the margin entire, acute; the context floccose, white. Pores rather small, round, acute, at length lacerate, becoming yellowish.

On fallen branches; rare. Pileus an inch or two in breadth, imbricate and variously concrescent, rather thick. Its substance is soft and light when dry, like the preceding, but it differs in its uniform and more conspicuous pubescence not arranged in zones.

55. P. *virgineus*, Schw. White. Pileus coriaceous, thin, tough, zonate, glabrous, radiately wrinkled, tuberculose; the margin thin, undulate; the context floccose-fibrous, white. Pores medium, round, entire; becoming thin, angular, acute.

In woods on old trunks; not common. The pilei have a peculiar habit of growing orbicular or with a helicoid or spirally imbricate arrangement, being attached by the center underneath; they vary in form, however, to reniform and dimidiate, and are sometimes

substipitate. The dried specimens have the alutaceous hue of the related species.

56. P. *conchifer*, Schw. Whitish. Pileus coriaceous, very thin, concentrically sulcate, glabrous, commonly reniform or flabelliform and substipitate. Pores medium, thin, acute, angulate, dentate, but scarcely lacerate.

In woods on sticks and fallen branches; common. A very singular species, and varying remarkably in form and size. It begins as a small cup, like a Peziza, furnished with a short, thick stipe, white without, and brown-zonate within; out of the edge of this cup, a very thin reniform or flabelliform pileus is developed, the cup appearing to be consumed in its growth; the pileus is commonly white or alutaceous, but sometimes the brown-zonate interior of the cup seems to be distributed in fragments over the surface. The pileus is rather small, not often exceeding an inch, sometimes lobed, extremely thin, and marked with faint concentric furrows.

57. P. *biformis*, Fr. Whitish or alutaceous. Pileus coriaceous, flexible, tough, subzonate, with innate radiating fibers; the context fibrillose, concolorous. Pores very large, simple, compound, or confluent, round, elongated and flexuous; the dissepiments dentate, then lacerate; the hymenium finally resolved wholly into teeth.

In woods on old logs; common. Pileus in its perfect form 2—3 inches wide and projecting 1½—2 inches, often imbricated and laterally confluent. It is often found with the pilei much effused, and more or less deformed, forming a thick, irregular mass with large and much lacerated pores. In the fresh, well-developed pileus, the alternate paler zones are quite conspicuous. The pores are large and irregular from the first, and the dissepiments are dentate. The older plants might be taken for an Irpex.

VIII. Coriacei. Pileus coriaceous, villous, banded with concentric zones commonly differently colored.

58. P. *hirsutus*, Wulf. Pileus corky-coriaceous, convexo-plane, hirsute with rigid hairs, uniform in color, but zonate with concentric furrows, whitish. Pores round, obtuse, whitish or brownish.

On wood of all sorts; very common. Pileus 2½—3½ inches in breadth, reniform, often imbricate, marked with conspicuous furrows and villous bands of the same color, the margin sometimes

darker. Pores entire, with thick dissepiments, commonly brownish, but sometimes whitish.

59. P. *velutinus*, Fr. Pileus corky-coriaceous, plane on both sides, soft-velvety, slightly zonate, white, at length yellowish; the margin extenuate, acute. Pores round, minute, thin, white.

In woods on old trunks and branches; not common. Pileus 1—2 inches in breadth, with a few delicate, pale, yellowish or brownish zones on its surface, and a fine short pubescence, rendering it soft-velvety to the touch. The younger plants are moist and somewhat spongy, but become hardened and corky. The pores become angular in drying, and the thin dissepiments are sometimes lacerate; they also assume a sordid or yellowish hue.

60. P. *zonatus*, Fr. Pileus corky-coriaceous, convex, tuberculose and gibbous behind, subzonate, villous, opaque; the margin whitish. Pores minute, round or angulate, obtuse, whitish.

On trunks and branches of sugar maple; rare. Pileus 1½—2½ inches in breadth, cinereous, gray or ochraceous, villous, tuberculose at the base. It is thicker than the following species and lacks its shining zones; it more nearly resembles the forms of *P. hirsutus* with white pores.

61. P. *versicolor*, Linn. Pileus coriaceous, thin, rigid, applanate, depressed behind, even, velvety, shining, variegated with zones of different colors. Pores minute, round, acute and lacerate, white, afterward becoming pallid or yellowish.

On trunks of all kinds; one of the most common Polypori. Cæspitose, and densely imbricated, exhibiting a remarkable play of colors from gray or ochraceous to red, blue and various shades of brown. It is readily distinguished by its coriaceous rigid substance and by its shining zones of many colors.

62. P. *pergamenus*, Fr. Pileus coriaceous, thin, rigid, applanate, contracted at the base, tomentose, subzonate, virgate with innate radiating fibers. Pores at first small, irregular, dentate, purplish; soon lacerate into plates and bundles of teeth, and changing in color to pale or yellowish brown.

In woods on trunks of all kinds; very common. Pileus varying greatly in shape and size, sometimes effuse, reflexed and dimidiate, but when well developed, more or less attenuate at the base, and

obovate, reniform and flabellate; the margin thin and inflexed; the color whitish or subochraceous. "Immensæ confusionis mater," like the related *P. abietinus*, Dick. "Non exstat vero facilius distincta species, si *modo semel vegetum rite observaveris* nec in speciminibus exoletis et siccis species distinctas quæras." *P. laceratus*, Berk., and *P. elongatus*, Berk., are among its numerous synonyms.

[TO BE CONTINUED.]

Donations for April were announced as follows: From Hon. J. F. Follett, seven volumes and two pamphlets, viz., "Reports U. S. Fish Commission, 1881–1882," "Report of International Exhibition, 1876, 2 Vols.," "Report of Bureau of Education," "Report of Smithsonian Institution, 1882," "National Academy of Sciences, 1883," "Memoirs of Nat. Acad. Sciences, Vol. II.," "Bulletin of U. S. Fish Commission, Vol. IV.;" from Director of U. S. Geol. Survey, Nos. 2, 3, 4, 5, 6 of Bulletin; from Daniel G. Brinton, "Lineal Measures of Races of Mexico and Central America;" from Col. J. W. Abert, Lot of Minerals and Fossils; from Am. Cotton Oil Co., Samples of Oil Cake and Crude and Refined Oil; from Washburn College, Topeka, Kansas, "Bulletin of Laboratory, Vol. I., No. 3;" from Edw. M. Cooper, Eighteen Species of Shells; from J. Gamble, Jr., Specimen of Fœtus Born without Arms.

MEETING OF *May* 5, 1885.

PRESIDENT HARPER in the chair, and fourteen members present.

The following papers were read and submitted for publication:

AFFINITIES OF THE GENUS DIONÆA, ELLIS.

BY PROF. JOS. F. JAMES,
Custodian Cincinnati Society of Natural History.

THE order *Droseraceæ*, as considered in the *Genera Plantarum* of Bentham and Hooker, is made to include six genera. These are *Drosera*, *Drosophyllum*, *Aldrovanda*, *Dionæa*, *Roridula* and *Byblis*. With the exception of *Dionæa*, all these form a natural group. This one genus differs in such a manner that it seems more in accordance with natural principles, to change its position and place it with other relatives. An examination of the genera of the order

in which it is now placed, will show how much more it differs from than it accords with them. For instance: Four out of the six genera, viz.: *Drosera*, *Drosophyllum*, *Roridula* and *Byblis*, are circinate in venation, and have glandular stems and leaves. *Dionæa* is not circinate and is smooth. Four have a definite number of stamens (5), *Dionæa* has from 15 to 20. Five have either a two or three-celled, or a one-celled capsule with five valves. *Dionæa* has a one-celled, but a five-lobed capsule. Four of the genera (*Drosera* being world-wide, but with its metropolis in Australia), are Old World forms; *Dionæa* is American. So that when all things are taken together, *Dionæa* differs in more ways than it agrees with the family.

There is another order, however, that *Dionæa* does seem to agree with in many particulars. This order is *Sarraceniaceæ*, though with it *Dionæa* does not seem to have been associated since Lindley's time. The following table shows the characters of the genera and of the order *Sarraceniaceæ*:

Drosera.	*Drosophyllum.*	*Aldrovanda.*	*Roridula.*
Circinate.	Circinate.	?	Circinate.
Glandular.	Glandular.	Smooth.	Glandular.
Petals 4—5—8.	Petals 5.	Petals 5.	Petals 5.
Sepals 4—5—8.	Sepals 5.	Sepals 5.	Sepals 5.
Stamens 8.	Stamens 10—20.	Stamens 5.	Stamens 5.
Styles 2—5.	Styles 5.	Styles 5.	Styles 5.
Ovary 2—5-valved.	Ovary 5-valved.	Ovary 5-valved.	Ovary 3-celled.
Hab—The whole world.	Hab—Old World.	Hab—Old World.	Hab—Old World.
Byblis.	*Dionæa.*	*Sarraceniaceæ.*	
Circinate.	Non-circinate.	Non-circinate.	
Glandular.	Smooth.	Smooth.	
Petals 5.	Petals 5.	Petals 0—5.	
Sepals 5.	Sepals 5.	Sepals 4—6.	
Stamens 5.	Stamens 15—20.	Stamens 12 to ∞.	
Styles 1.	Styles 1.	Styles 1.	
Ovary 2-celled.	Ovary 5-lobed.	Ovary 3—5-celled.	
Hab—Old World.	Hab—New World.	Hab—New World.	

This table shows that in four most important respects *Dionæa* agrees with *Sarraceniaceæ* and differs from *Droseraceæ*. These four points are the smooth leaves, non-circinate vernation, numerous stamens and habitat. This last has not, seemingly, been taken into sufficient account in considering the affinities of plants. Especially is it so with small and natural orders. Yet these are the

very ones where it should receive most attention. From an evolutionary standpoint, plants which are near relatives must be considered as derived from a common ancestral form. The metropolis of *Drosera*, the main genus of the family, is in Australia, and probably nine-tenths of all the species of the order are Old World forms. It might be easy to imagine a few of the species of *Drosera* as reaching America from the Old World, but to imagine *Dionæa* developing from its far-away Asiatic relatives and leaving no intermediate links, or even to imagine a mode by which it could have reached its present habitat, is impossible. Therefore it seems as if its retention in *Droseraceæ* was unwise and adverse to principles of classification and evolutionary ideas. Its transference to another order, *Sarraceniaceæ*, is here proposed.

The chief and essential difference between the genera of *Sarraceniaceæ* and *Dionæa* is in the shape of the leaves. The well-known pitcher form is that characteristic of the first, and the blade, with its filaments and contractile power, that of the second. There can hardly be a doubt but that both came from a common ancestral form. If the theory that the leaves of the *Sarraceniaceæ* were developed from the hollow petioles of some plant allied to the water-lilies be correct,* then, after the pitcher was partly formed and the hood well developed, the expansion stopped and retrograded, while the blade went on differentiating, the beginning of the *Dionæa* leaf will be perceived.

The development of the winged petiole might have been necessary for the existence of the plant before it became so exclusively an insect feeder. Darwin considers the cilia and six sensitive filaments as having been developed from glandular hairs, like those of *Drosera*. It seems just as likely that they are modified internal hairs of some water-lily form. While the hairs on the hood and internal surface of *Sarracenia* were developing in a suitable way, those on the *Dionæa* branch pursued a different direction. It is probable that at one time hairs covered the whole surface of the *Dionæa* leaf blade; that in the course of time those near the edges grew into their present ciliate form, while those on the surface de-

* See article on this subject in Am. Nat., Vol. XIX, p. 567, June, 1885.

creased gradually in number and became more and more sensitive till they reached their present state of perfection.

It may be, that when the development of the blade and the petiole had proceeded a certain distance, the hairs of the blade caught and retained insects. If this proved beneficial in any way, then the enlargement of the petiole went no further, and the blade hairs commenced to be modified in the new direction. Some of them became the sensitive filaments; others, doubtless, came to form the minute glands which Darwin says cover the upper surface of the leaf, but no other portion.*

The order *Droseraceæ* itself has been placed in quite different positions in the sequence of orders by different authors. Bentham and Hooker and Decaisne situate it between *Crassulaceæ* and *Hamamelaceæ*, and consider it closely allied to *Saxifrageæ*. De Candolle places it between *Violaceæ* and *Polygalaceæ*. Dr. Gray had it first between *Violaceæ* and *Cistaceæ*, but now has it between the latter and *Hypericaceæ*, though allied to *Violaceæ*. Nuttall considered it closely related to *Hypericaceæ*; Wood put it near this last order; Chapman between *Cistaceæ* and *Parnassiaceæ* (now with *Saxifragaceæ*), and Lindley, in his "Vegetable Kingdom," in close alliance with *Papaveraceæ*, *Sarraceniaceæ* and *Violaceæ*.

Considering, then, that the *Dionæa* leaf is one form of a development of which *Sarracenia* is the other, it is proposed to take *Dionæa* from *Droseraceæ* and place it in a section (*Dionæaæ*) of *Sarraceniaceæ*. Then some of the other orders should be arranged differently. If a lineal system is to be observed, it seems the closest approximation to a natural arrangement to place them as follows: *Nymphæaceæ*, *Sarraceniaceæ*, *Droseraceæ*, *Papaveraceæ*, *Hypericaceæ*.

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*In this connection the thought arises that the "quadrifid processes" of *Aldrovanda* and *Utricularia* may be the modified internal stellate hairs of some water plant, just as the glands of *Dionæa* may be the modified internal stellate hairs of the hypothetical water-lily.

PROGRESS OF VEGETATION IN THE OHIO VALLEY.

By Prof. Jos. F. James.

The spring of the present year seeming so backward, and many thinking that other springs have been much in advance of this, a review of a record kept of the early flowering plants for eight years may now be of interest. The first appearance of flowers is a more reliable indication of the condition of the weather and of the temperature than the thermometer. Plants indicate the general average of climatic conditions, and the species appearing in much the same sequence indicate the progress of spring. In the table here presented, of fifteen species of the first flowers which generally appear, quite a number of facts are to be noted. It is to be noticed that every alternate year is a cold year, or one at least with a backward spring. The years 1874, 1876, 1878 and 1884 are forward ones, while 1875, 1877, 1883 and 1885 are backward. If the years 1879, 1880, 1881 and 1882 could be tabulated in the same way, it is probable that 1880 and 1882 would show a forward and 1879 and 1881 a backward spring. In 1874, eleven out of the fifteen were found between the 19th and 26th of March. In 1876, nine out of the fifteen were out between February 12 and March 14. In 1878, the eleven of which there is record were out between March 3 and March 18, and in 1884 the thirteen recorded were out between March 16 and March 30. These were the forward years. Then in 1875 fourteen out of fifteen were out between March 30 and April 11. In 1877 two were out on March 4, and none others until the 1st of April, and between that and the 12th there were twelve in bloom. In 1883 two were out on March 4, next one of March 13 and then ten between April 6 and April 12. Lastly, in the present year, the first flower appeared on April 1, and thirteen others up to April 20.

Account is here taken of only fifteen species. More than these fifteen appeared in each year in the time mentioned, but no record of them is here considered. The species named may be regarded as the typical early flowers, although there are others which may be nearly as early.

The earliest year of all the eight is 1876. In that year the

Spring Cress (*Cardamine rotundifolia*) was in bloom on February 12, and the Dandelion (*Taraxacum densleonis*), generally the earliest composite, on April 7. In 1875 the first flower (*Ulmus*

	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885
Acer dasycarpum, ...		4/4	2/26	4/1	3/8		Early season. Dr. Warder found *Phacelia Purshii* in bloom in Jan. J. C. S. N. H., V. 66.		Early season. First plant probably in bloom about Feb. 23.	3/4	3/23	4/1
Symplocarpus foetidus, . . .	4/19 *	4/6	2/13	3/4	3/3					3/4	3/18	4/5
Erigenia bulbosa, ...	3/26	4/6	2/13	4/1	3/3					4/8	3/16	4/5
Anemone (Hepatica) acutiloba,	3/19	4/6	4/2 *	4/1	3/8					4/6	3/23	4/12
Sanguinaria Canadensis, . .	3/29	4/8	—	4/1	—					4/12	3/24	4/12
Ulmus Americana, . . .	3/22	4/4	2/27	4/1	3/8					4/6	3/16	4/6
U—— fulva, ...	3/19	3/30	2/27	4/1	3/10					4/6	3/28	4/10
Cardamine rotundifolia, . .	3/22	4/7	2/12	3/4	3/8					3/13	3/23	4/18
Erythronium albidum, . . .	3/26	4/8	3/14	4/12	3/18					4/12	3/23	4/18
Claytonia Virginica, . . .	3/22	4/6	2/13	4/1	3/8					4/8	3/24	4/18
Capsella bursa-pastoris, . .	3/22	4/7	4/2 *	4/2	3/10					4/13	3/30	4/19
Anemone thalictroides, . .	3/22	4/7	3/12	4/1	3/10					4/6	3/27	4/19
Dentaria laciniata, ...	4/16	4/11	4/2	4/7	—					4/12	3/30	4/20
Jeffersonia diphylla, . . .	4/20	4/11	—	4/8	—					—	—	4/20
Taraxacum densleonis, . .	4/19	4/29	4/7	4/15	—					—	—	4/26

* This is probably not the first out, but was first found on this day.

fulva), Red Elm, was in bloom March 30, and the Dandelion on April 29, while this year, which is, in many respects, the counterpart of it, the first flower, White Maple (*Acer dasycarpum*), was out on April 1 and the Dandelion on April 26. But even 1875, the most backward of all, was, on an average, six days in advance of this year; so that the present year is really a week later than any in the eight recorded years, and seven weeks and two days later than the earliest year (1876) out of the same eight.

In looking at the list, it is further found that three out of these fifteen early flowers are trees; nine of the remainder are provided with bulbs, tubers or rhizomas, in which nourishment is stored up. One (*Hepatica*) has persistent, evergreen leaves, one has a perennial root, and only the remaining one (*Capsella*) seems to have no special fund upon which to draw. The importance, then, to herbs of a store of matter which can be speedily utilized at the first opportunity is here well shown.

NOTE.—At the meeting of the Society on May 5, Dr. O. D. Norton corroborated the statement that every alternate year has a backward spring, and stated that he remembered the winter of 1879 and 1880 was very mild. In Vol. V. of the JOURNAL of this Society, p. 65. *et seq*, is given a list of sixty species of native plants observed in bloom by Dr. Warder on the 4th of April, 1882. A note by D. L. James adds that fifty-one species were observed by him on April 9, 1882, within a limited locality. Comparing the lapse of time in other years for fifty species to come into flower, it is found that the average is about forty days. Deducting, then, the forty days from April 4, would indicate that the first flower was in bloom about February 23. This is sufficient to show the forwardness of the spring, and further corroborates the assertion that in every alternate year the spring is late.

The Secretary read a letter from S. D. Peet, of Clinton, Wisconsin, in relation to an article by Dr. W. A. Dun, published in the last number of the JOURNAL. He agreed with Dr. Dun as to the importance of accurately locating and describing all archæologica- "finds," and said: "In the year 1879, there was found a portion of the skeleton of a mastodon in a peat-bed, and near it an arrow-head. This was in Ashtabula County (Ohio). The 'surroundings' were very similar to those described by Dr. Dun, though in his 'find' there was only an arrow-head, and not a mastodon. The peat-swamp was not so large, as it was only two or three rods across, but it contained peat and white marl, and evidences of fire, the same as the swamp he discovered. The signs of fire gave to me the idea that it was in the prehistoric age that the swamp had

been burned, or at least that the fire had been kindled near the mastodon, for the coal was at the same depth as the bones. These last were imbedded in the peat, beneath the white marl. Surrounding the bones was a black substance, which may have been either vegetable or animal; I am not able to say which, yet I think it was the latter. This find proves to me that the mastodon had a very late existence. The swamp was shallow, and could not have been of very great age. The peat in it was less than seven feet deep. Some of the bones were very near the surface, not over three feet below it, and appearances indicated that the animal had been mired. If it had been a domestic ox, it would not have appeared strange. The mastodon evidently fed upon the brushwood and rushes which grew in these swamps. The arrow-head was found at a depth of two feet, near the edge of this swamp, some twenty-five or thirty feet from the bones, and was an ordinary arrow-head like those used by the Indians."

The Secretary read a note by Mr. W. H. Fischer, recording the capture of four canvas-back ducks, near Ross Lake, near this city. Also a correction of a previous paper, to the effect that the Wood-Thrush reported to have wintered at Bellaire, Ohio, was the Towhee Finch, *Pipilo erythropthalmus*, Viell.

Specimens of *Strelitzia reginæ* and carpophylls of *Cycas circinalis* were exhibited and commented upon by Dr. O. D. Norton.

Specimens of bowlders from what was considered to be a terminal moraine, from near Cincinnati, were exhibited by Mr. J. R. Skinner.

Mr. E. S. Comings was elected to regular membership.

Mr. Karl Langenbeck and Mr. H. C. Fithian were proposed for membership.

The position of Curator of Entomology, left vacant at the last meeting, was filled by the election of Geo. S. Huntington.

Mr. Chas. Dury, Chairman of the Committee on the Treasurer's accounts, reported everything correct. In accordance with the recommendation of the Committee, a vote of thanks was tendered the Treasurer, Mr. Wright, "for the efficient, neat and correct method of keeping the accounts, and performing the duties of the position in so satisfactory a manner."

The following were appointed a Committee to arrange for a celebration of the birthday of Prof. Louis Agassiz, on May 28.

Mr. J. R. Skinner. Mr. D. L. James.
Mr. Geo. B. Twitchell. Dr. J. H. Hunt.
Mr. R. H. Warder.

A letter was read from Mrs. Gibson, accepting her election to honorary membership.

Donations for the month were announced as follows: from Edw. M. Cooper, "Naturalist's Directory for 1878, 1879, 1880, 1882–83," large lot of Fresh Water Shells from Alabama and Georgia, and Coal Plants from Pennsylvania, Alabama, etc.; from H. W. Stephenson, "Spallazani's Travels in Italy;" from Smithsonian Institution, Nos. 34, 35, 36, 37, 38, 39, and Plates I. and II. of Vol. VII. of Proceedings of U. S. Nat. Museum; from Bureau of Education, "Circulars of Information, No. 7, 1884, No. 1, 1885," "Planting Trees," etc.; from Dr. S. W. Francis, four pamphlets; from Chief Signal Officer, "Monthly Weather Review, Feb., 1885;" from U. S. Geol. Survey, "Lord on Comstock Mining and Miners;" from Dr. J. S. Newberry, two pamphlets; from Meriden Scientific Association, Conn., "Transactions, Vol. I., 1884;" from Department of the Interior, Vol. VIII., U. S. Geol Survey of Territories under Hayden; from Prof. Eugene Smith, "Report on Cotton Production of Alabama;" from Missouri Historical Society, "Publication No. 8."

Meeting of *June* 2, 1885.

President Harper in the chair, and twelve members present.

The following paper was read and referred to the Publishing Committee:

CATALOGUE OF THE COLLECTIONS

OF THE

CINCINNATI SOCIETY of NATURAL HISTORY.

COMPILED BY

JOSEPH F. JAMES, CUSTODIAN,

AND

CHARLES DURY, CURATOR.

THE following catalogue of the Coleoptera in the collection of the Society has been compiled in accordance with the instructions of the Executive Board of the Society. It shows the species of beetles in the collection at the present writing.

Donations of *any* species not in this list will be thankfully received and acknowledged. The list is arranged according to families. The compilation was the work of the Custodian, but corrections in nomenclature were made by the Curator, and it is believed to be in accordance with the latest authorities.

J. F. J.
C. D.

PART II.—COLEOPTERA.

CICINDELIDÆ.

Omus.
 Audouini, Reiche.
Tetrachia.
 Carolina, L.
 Virginica, L.
Cicindela.
 cuprascens, Lec.
 dorsalis, Say.
 12-guttata, Dej.
 generosa, Dej.
 gratiosa, Gruer.
 modesta, Dej.
 punctulata, Fab.
 purpurea, Oliv.
 repanda, Dej.
Cicindela
 rufiventris, Dej.
 sex-guttata, Fab.
 tanquebarica, Hb.
 unicolor, Dej.

CARABIDÆ.

Elaphrus.
 riparius, L.
 ruscarius, Say.
Notiophilus.
 semistriatus, Say.
 sibiricus, Mots.
Nebria.
 pallipes, Say.

Calosoma.
calidum, Fab.
externum, Say.
Sayii, Dej.
scrutator, Fab.
Wilcoxi, Lec.
Carabus.
limbatus, Say.
vinctus, Web.
Cychrus.
Lecontei, Dej.
Pasimachus.
elongatus, Lec
marginatus, Fab.
morio, Lec.
sub-sulcatus, Say.
Scarites
subterraneus, Fabr.
Dyschirius.
sphæricollis, Say.
Clivina.
bipustulata, Fabr.
Brachynus.
conformis, Dej.
cyanipennis, Say.
fidelis, Lec.
fumans, Fab.
puberulus, Chd.
Galerita.
janus, Fabr.
Casnonia.
pennsylvanica, L.
Loxopeza.
atriventris, Say.
grandis, Hentz.
Lebia.
pumida, Dej.
viridis, Say.
Cymindis.
pilosa, Say.
Calathus.
gregarius, Say.
impunctata, Say.
ruficollis, Dej.
Pristonychus.
complanatus, Dej.
Platynus.
bicoloratus, Gamm.
brunneomarginatus, M.
cupripennis, Say.
extensicollis, Say.
maculicollis, Dej.
melanarius, Dej.
obsoletus, Say.
punctiformis, Say.
subsericeus, Lec.
sulcatus, Dej.
Evarthrus.
gravidus, Hald.
rotundatus, Lec.
seximpressus, Lec.
sodalis, Lec.
Pterostichus.
adoxus, Say.
californicus, Dej.
coracinus, Newn.
erythropus, Dej.
honestus, Say.
lacrymosus, Newn.
lucublandus, Say.
Luczotii, Dej.
patruelis, Dej.
Sayii, Brullé.
Amara.
angustata, Say.
avida, Say.
cupreolata, Putz.
fallax, Lec.
inepta, Lec.
obesa, Say.
Dicælus.
dilatatus, Say.
elongatus, Dej.
ovalis, Lec.
politus, Dej.
purpuratus, Bon.
reflexus, Lec.
teter, Bon.

Chlænius.
æstivus, Say.
erythropus, Germ.
nemoralis, Say.
orbus, Horn.
rufipes, Dej.
sericeus, Forster.
Agonoderus.
pallipes, Fab.
Anisodactylus.
agricola, Say.
Baltimorensis, Say.
carbonarius, Say.
consobrinus, Lec.
Harrisi, Lec.
punctulatus, Lec.
rusticus, Dej.
Amphasia.
interstitialis, Say.
Bradycellus.
rupestris, Say.
Harpalus.
caliginosus, Fabr.
compar, Lec.
erraticus, Say.
erythropus, Dej.
faunus, Say.
fraturnus, Lec.
herbivagus, Say.
nitidulus, Chd.
ochropus, Kby.
pennsylvanicus, Dej.
viridæneus, Beauv.
Stenolophus.
conjunctus, Say.
limbalis, Lec.
ochropezus, Say.
Patrobus.
longicornis, Say.
Bembidium.
coxendix, Say.
inæquale, Say.
lævigatun, Say.
patruele, Dej.

Bembidium.
rupestre, Dej.
versicolor, Lec.

HALIPLIDÆ.

Haliplus.
ruficollis, Dej.
triopsis, Say.

DYTISCIDÆ.

Hydroporus.
mebilis, Lec.
Laccophilus.
fasciatus, Aube.
maculosus, Germ.
Acilius.
fraternus, Harr.
Dytiscus.
marginicollis, Lec.
Ilybius.
confusus, Aube.
Gaurodytes.
gagates, Aube.

GYRINIDÆ.

Dineutus.
assimilis, Aube.
discolor, Aube.
Gyrinus.
picipes, Aube.

HYDROPHILIDÆ.

Tropisternus.
californicus, Lec.
glaber, Hb.
minbatus, Say.
Hydrocharis.
obtusatus, Say.
Philhydrus.
cinctus, Say.

STAPHYLINIDÆ.

Creophilus.
villosus, Grav.

Leistotrophus.
cingulatus, Grav.
Staphylinus.
cinnamopterus, Grav.
maculosus, Grav.
Philonthus.
æneus, Rossi.
apicalis, Say.
Baltimorensis, Grav.
cyanipennis, Fabr.
Cryptobium.
bicolor, Grav.
Sunius.
linerais, Er.

PSELPHIDÆ.

Ctenistes.
piceus, Lec.
Batrisus.
globosus, Lec.
Tyrus.
humeralis, Aube.

SILPHIDÆ.

Silpha.
americana, Oliv.
marginata, Fab.
orbicollis, Say.
tomentosa, Web.
Peltis.
americana, L.
inæqualis, Fab.
ramosa, Say.
surinamensis, Fab.
Cholera.
opaca, Say.

CORYLOPHIDÆ.

Sacium.
fasciatum, Say.

DERMESTIDÆ.

Dermestes.
lardarius, L.
marmoratus, Say.
nubilus, Say.
Attagenus.
megatoma, Fab.
Anthrenus.
varius, Fab.
Orphilus.
subnitidus, Lec.

TRITOMIDÆ.

Tritoma.
flexuosus, Say.

EROTYLIDÆ.

Languria.
trifasciata, Say.
Megalodacne.
fasciata, Fab.
heros, Say.
ulkei, Dr.
Triplax.
thoracica, Say.
Isychrus.
quadri-punctatus, Oliv.
Cypherotylus.
Boisduvali, Chev.

ATOMARIIDÆ.

Silvanus.
bidentatus, Fab.
planatus, Germ.
Nausibius.
dentatus, Msh.
Atomaria.
ephippiata, Zimm.

CUCUJIDÆ.

Catogenus.
rufus, Fabr.
Cucujus.
clavipes, Fabr.

RHYSSODIDÆ.

Rhyssodes.
exaratus, Ill.

TROGOSITIDÆ.

Trogosita.
virescens, Fab.

Alindria.
cylindrica, Serv.
Tenebrioides.
castanea, Mels.
corticalis, Mels.
nana, Mels.

NITIDULIDÆ.

Trixagus.
unicolor, Say.
Cercus.
abdominalis, Er.
Colastus.
niger, Say.
Carcophilus.
discoideus, Lec.
pallipennis, Say.
Epuræa.
rufa, Say.
Nitidula.
bipustulata, L.
ziczac, Say.
Pocadius.
helvolus, Er.
Cybocephalus.
nigritulus, Lec.
Pityophagus.
4-guttatus, Fab.

PHALACRIDÆ.

Olibrus.
apicalis, Mels.
striatulus, Lec.

COCCINELLIDÆ.

Megilla.
maculata, DeG.
Hippodamia.
ambigua, Lec.
convergens. Guer.
13-punctata, L.
parenthesis, Say.
Coccinella.
franciscana, Muls.
9-notata, Hb.
trifasciata, L.
Cycloneda.
sanguinea, L.
Epilachna.
borealis, Fab.
Adalia.
bipunctata, L.
Harmonia.
picta, Rand.
Psyllobora.
20-maculata, Say.
Oeneis.
pusilla, Lec.
Brachyacantha.
ursina, Fab.
Scymnus.
hæmorrhous, Lec.

CISTELIDÆ.

Limnichus.
obscurus, Lec.

HISTERIDÆ.

Hololepta.
fossularis, Say.
Saprinus.
assimilis, Payk.

LUCANIDÆ.

Lucanus.
dama, Thunb.
Dorcus.
parallelus, Say.
Platycerus.
quercus, Weber.
Passalus.
cornutus, Fabr.

SCARABÆIDÆ.

Canthon.
hudsonius, Forst.
nigricornis, Say.
simplex, Lec.
Choeridium.
histeroides, Web.
Copris.
anaglypticus, Say.
minutus, Dr.

Phanæus.
carnifix, Linn.
nigrocyaneus, McLeay.
Onthophagus.
canadensis, Fabr.
latebrosus, Fabr.
Janus, Panz.
Aphodius.
femoralis, Say.
fimetarius, Linn.
inquinatus, Hb.
stercorosus, Mels.
terminalis, Say.
Atænius.
gracilis, Mels.
stercorator, Fabr.
Euparia.
strigatus.
Ochodæus.
pectoralis, Lec.
Bolboceras.
farctus, Fabr.
lazarus, Fabr.
Odontæus.
filicornis, Say.
Geotrypes.
Blackburnii, Fab.
splendidus, Fab.
Clœotus.
globosus, Say.
Trox.
gemmulatus, Horn.
porcatus, Say.
sonoræ, Lec.
terrestris, Say.
Dicheclonycha.
linearis, Gyll,
Serica.
sericea, Ill.
vespertina, Schöon.
Macrodactylus.
subspinosus, Fabr.
Diplotaxis.
Harperi, Blanch.
Diplotaxis.
liberta, Germ.
tristis, Kirby.
Phyllophaga.
fusca, Fröhl.
hirsuta, Knoch.
rugosa, Mels.
tristis, Fabr
villifrons, Lec.
Listrochelus.
falsus, Lec.
Tostegoptera,
lanceolata, Say.
Anomala.
binotata, Gyll.
lucicola, Fabr.
marginata, Fabr.
minuta, Burm.
variana, Fabr.
Strigoderma.
arboricola, Fabr.
Pelidnota.
punctata, L.
Cotalpa.
consobrina, Horn.
Cyclocephala.
immaculata, Burm.
Chalepus.
trachypygus, Burm.
Ligyrus.
gibbosus, DeGeer.
Allorhina.
mutabilis, Gory.
Trichius.
affinis, Gory.
delta, Forst.
piger, Fabr.

BUPRESTIDÆ.

Gyascutus.
cælatus, Lec.
Chalcophora.
angulicollis, Lec.
liberta, Germ.

Psiloptera.
    Webbii, Lec.
Dicerta.
    asperata, Lap.
Buprestis.
    maculiventris, Say.
Anthaxia
    cyanella, Gory.
Chrysobothris.
    femorata, Lec.
    4–impressa, Gory.
    octocola, Lec.
Acmæodera.
    connexa, Lec.
    culta, Web.
Agrilus.
    bilineatus, Web.
    egenus, Gory.
    interruptus, Lec.
    ruficollis, Fab.

ELATERIDÆ.

Adelocera.
    discoidea, Web.
Chalcolepidius.
    Webbii, Lec.
Alaus
    myops, Fabr.
    oculatus, L.
Cardiophorus.
    gagates, Er.
Elater.
    nigricollis, Hbst.
Drasterius.
    dorsalis, Say.
Monocrepidius.
    auritus, Hbst.
    lividus, Deg.
Ludius.
    abruptus, Say.
    attenuatus, Say.
Agriotes.
    fucosus, Lec.
    pubescens, Mels.
Glyphonyx.
    recticollis, Say.
Melanotus.
    communis, Gyll.
    fissilis, Say.
    Oregonensis, Lec.
Limonius.
    cylindriformis.
    griseus, Beauv.
    griseus, var interstitialis, Muls.
Sericosomus.
    silaceus, Say.
Corymbites.
    aethicps, Hbst.
    hieroglyphicus, Say.
    sulcicollis, Say.
Melanactes
    piceus, DeG.
    puncticollis, Lec.

RHIPICERIDÆ.

Zenoa.
    picea, Beauv.
Sandalus.
    niger, Knoch.

DASCYLLIDÆ.

Cyphon.
    bicolor, Lec.

LAMPYRIDÆ.

Lycus.
    cruentus, Lec.
Calopteron.
    typicum, Newm.
Cænia.
    basilis, Newm.
Photinus.
    pyralis, L.
    scintillans, Say.
Photuris.
    pennsylvanica, DeG.

TELIPHORIDÆ.

Chauliograthus.
    Americanus, Forst.
    basilis, Lec.
Phodabrus.
    rugosulus, Lec.
    tricostatus, Say.
Telephorus.
    bilineatus, Say.
    carolinus, Fabr.
    imbecilis, Lec.

MALACHIDÆ.

Collops.
    4-maculatus, Fab.

CLERIDÆ.

Cymatodera.
    bicolor, Say.
Clerus.
    ichneumoneus, Fabr.
    nigripes, Say.
    rosmarus, Say.
    thoracicus, Oliv.
Corynetes.
    ruficollis, Fabr.
    rufipes, Fabr.

PTINIDÆ.

Eucrada.
    humeralis, Mels.
Sitodrepa.
    panicea, L.
Cænocara.
    oculata, Say.
Sinoxylon.
    declive, Lec.
Amphicerus.
    bicaudatus, Say.
Polycaon.
    stoutii, Lec.

SPONDYLIDÆ.

Parandra.
    brunnea, Fab.

CERAMBYCIDÆ.

Ergates.
    spiculatus, Lec.
Orthosoma.
    brunneum, Forst.
Prionus.
    Californicus, Motsch.
    laticollis, Drury.
Hylotrupes.
    ligneus, Fab.
Phymatodes.
    decussatus, Lec.
Chion.
    garganicus, Fab.
Eburia.
    perforata, Lec.
    quadrigeminata, Say.
Elaphidion.
    atomarium, Drury.
    villosum, Fab.
Purpuricenus.
    humeralis, Fab.
Aethecerus.
    latecinctus, Horn.
Ischnocremis.
    bivittatus, Dup.
Cyllene.
    robiniæ, Forst.
Glycobius.
    speciosus, Say.
Arthopalus.
    fulminans, Fab.
Clytus.
    marginicollis, Lap.
Xylotrechus.
    colonus, Fab.
    undulatus, Say.
Neoclytus.
    capræa, Say.
    erythrocephalus, Fab.
Euderces.
    picipes, Fab.
Desmocerus.
    palliatus, Forst.

Toxotus.
cylindricollis, Say.
Gaurotes.
cyanipennis, Say.
Typocerus.
velutenus, Oliv.
Leptura.
canadensis, Fab.
proxmia, Say.
Tetraopes.
canteriator, Drap.

SPERMOPHAGIDÆ.

Mylabris.
mimus, Say.

CHRYSOMELIDÆ.

Saxinus.
saucia, Lec.
Cryptocephalus.
auratus, Fab.
Myochrous.
denticollis, Say.
Chrysomela.
Bigsbyana, Kby.
clivicollis, Kby.
Gastrophysa.
cæsia, Rog.
polygoni, Linn.
Trirhabda.
canadensis, Kirby.
flavolimbata, Mann
Disonycha.
abbreviata, Mels.
Graptodera.
chalybea, Ill.
Crepidodera.
atriventris, Mels.
rufipes, L.
scabricula, Cr.
Coptocycla.
clavata, Fab.
Pachybrachys.
tridens, Mels.

TENEBRIONIDÆ.

Cryptoglossa.
verrucosa, Lec.
Asida.
angulata, Lec.
elata, Lec.
opaca, Say.
rimata, Lec.
sordida, Lec.
Coniontis.
Eschscholtzii, Mann.
Elodes.
gigantea, Mann.
gracilis, Lec.
Lecontii, Horn.
obsoleta, Say.
quadricollis, Esch.
tricostata, Say.
Iphthimus.
serratus, Mannh.
Phaleria.
rotundata, Lec.
Corticcus.
parallelus, Mels.

LAGRIIDÆ.

Arthromacra.
ænea, Say.
Statera.
splendens, Mels.

ANTHICIDÆ.

Notoxus.
monodon, Fabr.

MELANDRYIDÆ.

Hypulus
liturata, Lec.
Eustrophus.
bifasciatus, Say.

MELOIDÆ.

Megetra.
cancellata, Er.

Epicauta.
maculata, Say.
Cantharis.
viridana, Lec.
Tetraonyx
fulva, Lec.

CURCULIONIDÆ.

Eugnamptus.
Collaris, Gyll.
Balaninus.
rectus, Say.
Lissorhoptrus.
simplex, Say.
Anthonomus.
4-gibbus, Say.
Artipus.
floridanus, Horn.
Analcis.
foveolatus, Say.
Conotrachelus.
erinaceus, Dej.
Rhinoncus.
pyrrhopus, Boh.
Sphenophorus.
pulchellus, Schon.

SCOLYTIDÆ.

Scolytus.
rugulosus, Ratz.

ANTHRIBIDÆ.

Eurymycter.
fasciatus, Oliv.
Eusphyrus.
Walshii, Lec.
Brachytarsus.
variegatus, Say.

BRENTHIDÆ.

Eupsalis.
minuta, Drury.

*IN MEMORIAM—LOUIS AGASSIZ.**

By James A. Henshall, M. D.

Mr. President, Ladies and Gentlemen :—

Seventy-eight years ago to-day, as the morning stars sang together—their reflected forms sparkling on the bosom of the ever-restless sea, twinkling on broad rivers, dancing on tiny brooks, and flashing on ice-fields of Alpestrine heights—they proclaimed to the listening earth glad tidings of an event of unusual importance: the ushering into existence of one who was destined to follow the light of the stars into the depths of the sea to reveal its hidden mysteries; to track their paths by river and mountain-brook to Alpine glacier; and to wrench the rock-bound secrets from the bosom of earth itself.

* This paper was delivered by invitation at the "Memorial Exercises," held on Agassiz's birthday, May 28, 1885, at the Society's building, and is printed by a vote of the Society and the general request of the members.

On May 28, 1807, in the parish of Mottier, Canton of Freyburg, Switzerland, was born Louis Jean Rodolph Agassiz, whose name has become a household word in the land of his adoption. He was born, unheralded and unsung of man. No horoscope with red-fronted Mars, or flashing meteor, or blazing comet, had been cast by prophetic seer. He came as the rising of a silent star on a quiet night. His advent was in the glad springtime, with the opening of the leaves, with the budding of the flowers, with the love season of the birds; and stars of the smallest magnitude crowded their glad faces into the merry brook that went singing by the cot that gave him birth.

Having been invited by your Committee to offer a slight tribute to his memory, on this, his natal day, my only regret is that my ability is not more commensurate with my regard and veneration for his name and works.

I will, therefore, merely present a brief account of his fruitful life, which I deem a more fitting eulogy than the most brilliant panegyric that can be offered; and if I fail to do justice to, or even to mention, some of his achievements in the world of science, I trust you will bear with me patiently, for my remarks will be confined wholly within the province of the angler. And, as an angler, I take great pleasure in indulging in the fancy that, in all probability, the world is indebted, chiefly, to the love of angling acquired in his boyhood, for his wonderful scientific labors—labors of love, indeed, with him.

Born under the shadows of the snow-capped Alps, his lullaby the rushing mountain torrent, he was reared amid the grandest, wildest and most sublime features of Nature's handiwork. His early education was conducted by that best of all teachers—his mother, a very intelligent and accomplished woman, the daughter of a physician of the Canton de Vaud. Through all of his after years, the early influences of a mother's love and guidance were strongly apparent.

At the age of eleven he was sent, with a younger brother, to a school at Bienne, in the Canton of Berne, where, for four years, he studied ancient and modern languages, "diversified," says one account, "by the amusements of fishing and collecting insects."

Another writer says: "Before he left school (at Bienne), he began to collect and study into the habits of fishes." Now, the love of angling once firmly implanted in a boy's heart, it follows him through life, never to be wholly eradicated, but oftener to grow stronger with the accumulation of years, and not seldom influencing the whole course of his life. I know many men whose interest in natural history, and especially in biology, dates from the days of earliest childhood, when, with pin-hook and willow wand, they first essayed the gentle art, and produced consternation dire among the chubs and shiners of the brook. We, of the gentle craft, can readily imagine how eagerly young Agassiz turned from the wearisome school-room to the bright rippling waters of Lake Bienne, or to the foaming trout brooks of the Jura, and can fully appreciate the happy transition from the musty books of classic authors to the fair, bright pages of Nature's book. It seems to me that these early impressions, and this first love, must have had the greatest influence in shaping his subsequent career, as we may presently see.

His ancestors were of French origin, and were among the Huguenots who, in 1685, were forced to fly from their native country by the revocation of the Edict of Nantes. They found a safe and hospitable asylum in the free mountain air of Switzerland. For six generations the lineal ancestors of Agassiz were clergymen. His father was pastor of St. Imier, a Protestant parish in the ancient bishopric of Basel, and later of the parish of Mottier, (where Agassiz was born,) and still later he removed to Orbe, at the foot of the Jura Mountains, where a young clergyman instructed the willing student in botany, during his vacations from the school at Bienne.

Now it might readily be inferred, from the very nature of his home influences, and his antecedents, and from the operation of the laws of heredity, that he would naturally have followed in the well-beaten path of his predecessors, and have adopted the profession of his forefathers. And doubtless, this course would have been highly gratifying to his parents. But his mind and tastes were inclined in another direction, and how far they were formed and influenced by the "amusements of fishing and collect-

ing insects," while at the school in Bienne, I leave you to judge.

Leaving Bienne at the age of fifteen, he passed two years at the Academy of Lausanne, when it was decided that he should adopt the profession of medicine—perhaps at the solicitation of his mother, herself a physician's daughter, for I presume his parents now discovered that medicine, and its allied sciences, were more congenial to his tastes and inclination than the profession of his ancestors. Accordingly, he entered the medical school at Zurich at the age of seventeen, where he remained two years, and afterward continued his medical studies at the University of Heidelberg, devoting himself chiefly to anatomy, physiology, zoölogy and botany. At the age of twenty he entered the University of Munich, and was soon the intimate friend of the eminent scientific men there assembled. With Martius, the botanist, he studied the organization and geographical distribution of plants; he lived in the house of Döllinger, the founder of modern physiology, and with him studied embryology; with Oken, the zoölogist, he discussed the principles of classification; with Fuchs he studied mineralogy; and for four successive years he attended all of Shelling's lectures on philosophy. He was the leading spirit in a select circle of young men who formed a society to discuss scientific subjects, and so interesting were the lectures and discussions, that it is stated that the professors were glad to take part in them.

During his vacations at Heidelberg and Munich, Agassiz traveled on foot over the whole of Southern Germany and Switzerland, investigating the fresh-water fishes, and comparing those of the different water basins of the Rhine, the Rhone, and the Danube, with their tributaries, and collecting materials for his contemplated work on the fresh-water fishes of Central Europe. Though still a student, he had published several special papers, and, when but twenty years of age, he was selected by Martius, upon the death of Spix, to describe the fishes which that naturalist had collected in Brazil, and on which he produced a folio volume in Latin, of so much merit, that it at once placed him in the foremost rank of naturalists. In this work he characterized nine genera, embracing forty-two species new to science. So runs the record. But while all this

was in accordance with, and perhaps the outgrowth of, those "diversions of fishing and collecting insects" while a boy at the gymnasium in Bienne, it was very distasteful to his parents, who remonstrated against this devotion to science, and the neglect of his medical studies, and finding persuasion ineffectual, withdrew the small allowance he had formerly received from his father.

But a young man of such marked scientific attainments and indomitable perseverance was not likely to suffer for want of friends. Cotta, the great German publisher, and later, Mr. Christinat, a friend of his father, freely supplied him with funds to continue his studies and investigations. Meantime he received the degrees of doctor of philosophy at Erlangen, and doctor of medicine at Munich, passing the required examinations with unusual distinction.

He was now prosecuting with great vigor the preparation of his remarkable works on the fresh-water fishes, and the fossil fishes of Europe, in the interests of which he traveled over the most of Europe, accompanied by a skillful artist, collecting specimens, and examining the collections in the various museums; and to show how great an interest was universally felt in his researches, and the confidence which he inspired, it is stated that "he was allowed to take with him and keep for examination and comparison, the most valuable specimens of more than eighty public and private museums, some of which he was permitted to retain from five to ten years, in order the better to compare and describe them."

At Paris he became the attached friend of Cuvier and Humboldt. Cuvier had just begun his great work on fishes, and was so delighted with the drawings exhibited to him by Agassiz, "that he offered to relinquish to him all the materials he had himself collected"—the most sublime instance of devoted friendship of which I have any knowledge. Upon the death of Cuvier, in 1832, and when but twenty-five years old, Agassiz returned to Switzerland, by invitation, and was appointed Professor of Natural History in the College of Nêuchatel, holding the position until he came to America.

At thirty years of age he was a member of nearly every scientific academy of Europe, and had received the degree of doctor of

laws from the Universities of Dublin and Edinburgh. He received from the Academy of Sciences in Paris the Monthyon prize for experimental physiology, and the Cuvier prize; the Wollaston medal from the Geological Society of London, and the medal of merit from the King of Prussia. In his visits to England he was everywhere received with marked attention, favor and enthusiasm. He was noticed by royalty, entertained by nobility, and, best of all, his great fame, superior knowledge, and genial manner secured for him the friendship of the most eminent naturalists of that country.

During this period he published, in the transactions of the various scientific associations of Europe, many papers of great merit, embodying some of the results of his indefatigable investigations. It was through the liberality of Humboldt that he was enabled to begin the publication in 1833, of his great work on fossil fishes, a work of the highest order, comprising five volumes of 1,700 quarto pages, with an atlas of 400 folio plates. He established a great number of species, genera and families, and adopted an entirely new system of classification. He described and figured in natural size, about 1,000 species, with short indications of 700 more.

In 1836 he published a prodromus of the Echinoderms, or star fishes, followed the next year by a treatise on the fossil Echinoderms of Switzerland, and a year later began the publication of his monographs of living and fossil Echinoderms, a most important contribution to modern zoölogy. In 1839 he issued the first part of his great work on the fresh-water fishes of Central Europe, containing elaborate descriptions and plates of the genera *Salmo* and *Thymallus*. In 1840 he began the publication of his critical studies of fossil mollusks, and found time, during all these labors, to produce an annotated German translation of "Buckland's Geology," and to revise the German and French translations of "Sowerby's Mineral Conchology."

These were followed in 1842, by his "Nomenclator Zoölogicus," an alphabetical list of every known genus, with the etymology of the names, the names of the authors who first proposed them, the date of their publications, etc., the list embracing more than 1,700 names. This work was founded upon the registers in which

he entered the names of the animals as they occurred in his studies.

Agassiz is perhaps more popularly known through his studies of the glaciers. He first announced his Glacial Theory in 1837, and published his "Etudes sur les Glaciers," in 1840, followed in 1847 by his "Systeme Glaciaire." In collecting the facts relating to this subject, he spent eight summers upon the glaciers of Mont Blanc, the Bernese Oberland, and principally upon the glacier of Aar, 8,000 feet above the level of the sea, and twelve miles from any human habitation. What a heroic instance of zeal and devotion to a scientific problem!

Behold the great man who had been fêted in the gay capitals of Europe; who had been the recipient of all the honor that could be conferred by learned societies; the devoted friend of the wisest men of the age—wandering, alpenstock in hand, above the clouds, amid Alpine snows and glaciers, beneath the fierce glare of the noonday sun, under the cold glitter of the stars by night, with the thunder of the rushing torrent far below, and the faint, sweet echo of the alpen horn to remind him of the world beneath—exposed to many physical discomforts and hardships, while living in a hut of stone, during eight entire summers—and for what?—to prove the simple idea originating with the chamois hunter, that the immense bowlders scattered over the valleys beneath, were transported thence by glacial agency. But out of this simple idea the master-mind evolved the wonderful phenomena of glacial action.

In 1848, the Ray Society of London published his "Bibliographia Zoölogiæ et Geologiæ," containing a list of the authors and their works mentioned in his "Nomenclator Zoölogicus," with notices of all the periodicals devoted to zoölogy and geology.

"Special and technical as most of these works appear," says Prof. Felton, "an attentive student will perceive that each was undertaken with reference to some general question, and made a test of the value and soundness of some general principle. Everywhere we discover in his works a tendency to the most extensive generalizations, while in every instance the knowledge of the facts, a careful study of the most minute relations of his subjects, has been his constant aim in all his investigations."

In 1846, Agassiz was sent on a special scientific mission to the United States, by the King of Prussia, and at the suggestion of Humboldt, to study the natural history and geology of this country, and, incidentally, to deliver a course of lectures in Boston, in compliance with an invitation extended by Mr. John A. Lowell. These lectures on a general review of the animal kingdom, and a subsequent course on the glaciers and the phenomena connected with their former great extension, were attended by audiences of 1,500 to 2,000 interested and delighted listeners, embracing the most eminent in science and letters of the cultured society of Boston and vicinity. He visited many parts of the United States, North and South, investigating and comparing its animal fauna, actual and fossil, examining and studying its geological features. In the following year, Prof. Bache, Superintendent of the U. S. Coast Survey, offered him the facilities afforded by the Coast Survey, to aid in his researches. "The offer was so liberal," says Prof. Felton, "and of such vast importance, in a scientific point of view, that Agassiz could hardly credit his good fortune; and upon being assured that he might, without difficulty, visit at will every point of the coast in the well-equipped Coast Survey vessels, from Maine to Texas, and along the whole western coast, he exclaimed that this would decide him to remain to the end of his days in the United States."

He immediately availed himself of the liberal offer, and obtained an honorable discharge from his obligations to his Government; the Minister of Foreign Affairs, in granting his request, saying: "We well know, that wherever you take up your abode, your time will be employed for the best advantage of science."

The arrival of Agassiz in this country produced a new epoch in the history of zoölogy—the epoch of morphological and embryological zoölogy, or the developmental study of animals. Previous to this time, American naturalists had confined themselves, principally, to a study of systematic zoölogy. After his arrival, "American students who were attracted by his fame, were instructed in the methods of Cuvier, Von Baer, Döllinger and Agassiz himself, and zoölogy was studied from the side of histology and embryology,

while paleontology was wedded to the study of living animals." (Packard.)

In the same year of his arrival, he accepted the Professorship of Zoölogy and Geology in the newly-formed Lawrence Scientific School at Harvard, which position he held until his death, with the exception of the years 1852–3, when he occupied the Chair of Natural History in the University of South Carolina, lecturing on comparative anatomy at the Medical College of Charleston. In the meantime he made a thorough study of the marine animals of the South Atlantic Coast.

During the vacation of 1848, he projected a scientific exploration of the shores of Lake Superior, where with twelve of his pupils he passed the summer months. The result of the expedition he published in the well-known volume, entitled "Lake Superior," in which he compares its physical character, vegetation, and animals with those of other and similar regions, and fully discusses the evidences of glacial action in the United States.

In addition to his lectures at Harvard, he delivered lectures on scientific subjects in the principal cities of the Union, and explored the country from the Atlantic to the Rocky Mountains—from the great lakes to the Gulf of Mexico. He spent the winter of 1850 in the Straits of Florida, studying the growth of coral reefs, observing the phenomena of the Gulf Stream, and investigating the rich and varied fauna of that region.

For the next few years he devoted himself to the arrangement of the immense amount of material collected during his many journeys and explorations; enriching the different scientific periodicals, and transactions and proceedings of scientific societies with numerous communications of great value; and preparing his manuscript and materials for a series of "Contributions to the Natural History of the United States." This work was planned to comprise ten superb quarto volumes, in reference to which Prof. Felton says: "The subscription list extends to the unexampled number of 2,500 names, in all parts of the United States; a magnificent support of a purely scientific undertaking, executed on a grand and expensive scale; a tribute to the worth of science, and an appreciation of the

labors of a great original investigator, such as has never before been exhibited to the world."

The first two volumes appeared in 1857, the first containing an "Essay on Classification," and a history of the North American Turtles. The second was a treatise on the "Embryology of the Turtle." The third volume appeared in 1860, and a fourth in 1862; both these last volumes were devoted to the jelly-fishes. In the "Essay on Classification," in Vol. I., Agassiz affirms that "Nature is but the expression of the thought of the Creator, and that a true classification will be found to be but an unfolding of the plan of creation, as expressed in living realities; that these realities do not exist in consequence of the continued agency of physical causes, but appear successively by the immediate intervention of the Creator."

In the investigation of American fishes, Agassiz was the first, with the exception of Dr. Kirtland, of Ohio, to do justice to the labors of the eccentric Rafinesque, who described the fishes of the Ohio and its tributaries as early as 1820, but whose original and somewhat peculiar methods had been ignored by the closest naturalists of America and Europe, though they did not hesitate, in numerous instances, to appropriate as their own, many of his discoveries.

In 1865 Agassiz went to Brazil with a corps of assistants, under the auspices of Nathaniel Thayer, of Boston, and explored the Lower Amazon and its tributaries.

The great influence and popularity of Agassiz, led to the establishment in 1858, of that magnificent enterprise, the Museum of Comparative Zoölogy at Harvard. For this purpose Francis C. Gray gave $50,000, the citizens of Boston $70,000, and the State of Massachusetts the sum of $100,000. When the Legislature was considering the matter, Agassiz appeared before them. "My great object," he said, "is to have a museum founded here which will equal the great museums of the Old World. We have a continent before us for exploration, which has as yet been only skimmed on the surface . . . My earnest desire has always been, and is now, to put our universities on a footing with those of Europe, or even ahead of them; so that there would be the same disposition

among European students to come to America for the completion of their education that there always has been among our students to avail themselves of the advantages of European universities and schools . . . My idea in regard to the collections, is to furnish you with what money will not buy you when I am gone; with specimens which will be invaluable, because they can not be procured elsewhere. I receive no compensation whatever for the salaries of my assistants, but pay them out of my own pocket."

In 1869 Agassiz broke down under his untiring zeal and gigantic labors, but rallied again, and in 1872 conducted an exploring expedition on the Coast Survey steamer "Hassler," along the Atlantic and Pacific Coast, from Boston to San Francisco. Upon his return he gave his entire time to the practical development of his plans for the arrangement of his vast collections in the Museum of Comparative Zoölogy.

His last days were devoted to the cause of education, in the establishment of a summer school of practical natural history, at Penikese Island, in Buzzard's Bay, Massachusetts, where teachers might themselves be taught, and where naturalists might learn to read nature. The island, with an area of a hundred acres, with its improvements and buildings, the country-seat of Mr. John Anderson, of New York, were donated by him, together with a free cash gift of $50,000, for a permanent summer school. Only a few months before the death of Agassiz, the following delightful episode occurred at this school. I am sorry that I can not recall the name of the writer:

"On Saturday, the 26th of July (1873), while one of the students in the laboratory of the Anderson School, at Penikese Island, was dissecting a skate, he found in the body of the fish an egg. Now this may seem a matter of very small consequence, especially if he has walked along the beach and noticed how frequently the curious shell which incloses this egg may be seen. It certainly seemed quite an indifferent matter to the student, and, when he took his tray up to the professor to exhibit his discovery, he had very little idea of the sensation he was about to cause. An exclamation from Dr. Wilder, to whom it was first shown, brought forward Prof. Agassiz, and the excessive astonishment and satisfaction which he

manifested immediately called around him a wondering circle of ladies and gentlemen. Prof. Agassiz was interested in the egg; we in him, and it seemed quite worth our while to observe him as he studied it. Beaming and sparkling with delight, he surprised us by saying: 'No human eye, so far as recorded, has ever seen what we now see—an egg in the body of the skate. I have been looking for thirty years for this very thing.' He seemed as happy and as nervous as an inexperienced young maiden with an unexpected love-letter. When he began to trim away the flesh so as to show the egg in its bed to better advantage, his hand trembled so that he could hardly use it. But more was to come. As he was carefully, slowly, clipping away the fleshy covering, there came a sudden, a very expressive, 'Ah-h-h!' and then the words, 'Truly, here are two of them; how beautiful they are! The sight of these two eggs alone would pay me for my whole summer's work!' and then, with a soft, happy, boyish whistle, he went on with the dissecting, to make it ready for the drawing-master. When it was drawn, showing both eggs entire in the shells, it was brought down for a second dissection, preparatory to a second drawing. On removing the upper part of one of the shells, there appeared a very pretty egg, somewhat like a hen's egg, with this difference: the yolk was pink instead of yellow, and about half as large as the yolk of a hen's egg. Its general appearance, including the germinative vesicle, suggested the idea of some large bird's egg. At this the professor's feelings and the interest of the observing reached their climax. 'Before it is moved,' said he, 'I must take a good look at it, lest something happen to it. Ah!' continued he, 'it is a splendid sight; it is the most beautiful specimen I ever saw. Now, Dr. Wilder, raise it out of the water—stop! give me a look at it in the air before it goes into the alcohol. Yes, there is the blastoderm, perfect. Now, carefully lower it into the alcohol.' Then a long, fond, happy look before the utterance—evidently with intense feeling, and apparently with perfect sincerity—of the following words: 'I would not take two thousand dollars for that rare specimen. No human eye but ours has ever seen it. I would not exchange it for the Madonna of Raphael!'"

But there is a a limit beyond which human endurance can not

go, for the thread of life is but weak at best, and so, at last, came the end. On December 14 (the day on which Washington died), 1873, the busy hand, the eloquent tongue, the mighty brain, were stilled in death.

"As a naturalist," says Prof. Bliss, "Prof. Agassiz was unwearied in his devotion to his favorite pursuits. He worked early and late, often denying to himself the most necessary rest and recreation, and his remarkably strong constitution sustained him under a strain that would quickly have proved fatal to a man of less vigor."

"In the operation of his mind," says Whipple, the eminent critic, "there is no predominance of any single power, but the intellectual action of what we feel to be a powerful nature. When he observes, his whole mind enters into the act of observation, just as when he reasons, his whole mind enters into the act of reasoning. . . . He possesses not merely the talent of observation, but its genius, and hence his ability to perform the enormous tasks which he imposes on his industry. . . . He is not merely a scientific thinker; he is a scientific force; and no small portion of the immense influence he exerts is due to the energy, intensity and geniality which distinguish the nature of the man. In personal intercourse he inspires as well as informs; communicates not only knowledge, but the love of knowledge. . . . He is at once one of the most dominating and one of the most sympathetic of men, having the qualities of leader and companion combined in singular harmony. . . . Everybody feels that the indefatigable observer and thinker, who declined a lucrative lecture invitation because, he said, he could not *waste his time in making money*, has no other than public ends in his eager demands for public coöperation in his scientific schemes."

Agassiz was a firm believer in the diversity of origin of the human race. Says Prof. Bliss: "While denying the unity of origin of the races of mankind, he by no means denies their essential unity as one brotherhood. He regards all races of men as possessing in common the moral and intellectual attributes of humanity which raise them above the brutes. But intellectual relationship does not imply community of origin."

Prof. Agassiz, as we have seen, possessed a remarkable faculty for observing little things, With him no object or circumstance in nature was too trivial or insignificant for profound study or thought. And it was from the study of little things that he derived the facts which gave him his wonderful power of generalization. To me, as an angler, his greatest works are those devoted to fishes; and this habit of observing and studying little things led to his new system of classification of fishes, founded upon the form and character of their scales.

It is only by a contemplation of its parts that we can understand an object in its entirety. The world is made up of atoms. The microscopic portion of protoplasm called a cell, is the morphological unit of all organisms, vegetable and animal. The lowest form of animal known consists of but a single cell, and by studying this one-celled animal "one can better understand the structure and physiology of the highest and most specialized forms, even that of man." (Packard.)

When the boy Agassiz began collecting and studying the habits of fishes, the cell theory was unknown, but there was no minnow too small to escape his observation, and no part of that minnow too insignificant for his closest scrutiny and study. In this way he was the first to separate and properly define that most difficult group of fishes, the *Cyprinidæ,* as a family, by the form, number and arrangement of their pharyngeal teeth; and any one who has ever examined the minute teeth in the throat of a minnow, can appreciate, somewhat, the amount of careful study and observation involved in his investigations.

In his study of the salmon, trout and grayling species, he exhibited the same careful and characteristic mode of inquiry. Of this family Günther says: "As much time and patience are required for the investigation of a single species as in other fishes for that of a whole family. . . . The almost infinite variations of these fishes are dependent on age, sex and sexual development, food and the properties of the water." In consequence of these variations and peculiarities, many species had been predicated upon coloration alone. Agassiz showed the fallacy of this, for he found that fish in clear, sunny waters, with gravelly bottoms, were highly

and brightly colored; while those in shady streams, or where the bottom was dark or muddy, and the water not so clear, were correspondingly dusky in hue; and that bright fish taken from waters of the former character and placed in those of the latter would begin to fade in a few hours, and in a few days or weeks would become entirely changed in hue. He found that the color of brook trout of neighboring streams was influenced by the color and quantity of the water, and that even trout of the same stream differed in color as they frequented the shady or sunny side.

Now, while most persons are capable of admiring the general result of a long series of observations or experiments, many can not appreciate, or may even be disposed to make light of, some of the seemingly preliminary steps leading to that result. And a person of this character coming upon Agassiz beside a trout stream, studying the changes in coloration of the brook trout—than which there is no lovelier object on God's footstool—might have thought it a sad waste of time, or at least, a subject unworthy the notice of so wise a man.

The battle-scarred warrior who leads his marshaled hosts to victory; the intrepid voyager who defies the hibernal terrors of the Arctic seas; the hardy traveler who braves the scorching sun, the simoon or the sirocco of tropical lands; the brilliant divine who expounds, in a lofty manner, the simple gospel of the lowly Christ—all are admired and applauded and fêted and honored of men; but rising superior to all of these is the simple, grand man, seated on the mossy bank, contemplating the ruby-studded, living arrow of the mountain stream. Yea, greater than warrior, or voyager, or traveler, or divine—a very high priest of Nature in God's own temple. What cathedral aisle more imposing than the Gothic arch of pine and fir? What font more pure than the babbling brook? What surpliced choir more redolent of praise than Nature's feathered choristers? What altar cloth more sacred than the velvet sward? Surely

"The groves were God's first temples,"

and Solomon's Temple, in all its pristine glory and regal splendor, was but a barren waste in comparison! And no mitred archbishop, in temple built by human hands, ever engaged in a loftier, nobler

or more reverent work than Louis Agassiz, whose efforts to trace out the plan of creation, to the glory of God, led him from the bottom of the vasty deep, from the rock-ribbed foundations of the earth, to the loftiest summit of the star-kissed Alps; whose mighty genius and unconquerable energy raised him from an obscure Swiss hamlet to the highest pinnacle of fame; who sacrificed himself on the altar of his devotion, and who has left us the precious legacy of his life, fossilized in his works, the proud heritage of his memory crystallized in our hearts, and they will endure unto the end.

Donations for the month were announced as follows: From Director of United States Geological Survey, Vol. IV. of Monographs of the Survey; from F. W. Cragin, "Faunal Relations of Kansas, Etc."; from T. H. Wise, "Young Mineralogist, Vol. I, No. 10;" from Chief Signal Officer, "Monthly Weather Review, March, 1885;" from Tiffany & Co., "Catalogue of Rough Diamonds;" from Smithsonian Institution, "Proceedings of United States National Museum, Vol. VII, Title and Index, Vol. VIII., Nos. 1–5;" from D. A. McCord, two casts of *Asaphus megistos*, showing locomotory appendages; from Edward M. Cooper, "Proceedings of Worcester Society of Antiquity, No. 22;" from Jos. Smith, one green snake; from Mrs. L. M. Dury, photographs of bust of Agassiz; from Chas. Dury, skins of Florida Gallinule, Passenger Pigeon, Pintail, Merganser, Blue-winged Teal, Butter Ball, Chestnut-collared Duck, Ruddy Duck, Red-head, Great Marbled Godwit, Yellow-legged Sandpiper; from Zoölogical Garden, skins of Silver Pheasant, English Pheasant, and Agouti; from J. L. Shepard, four arrow points.

[The following papers were read at the July meeting of the Society, and are here printed at the special request of the Society]:

NOTES ON THE TERTIARY OF ALABAMA AND MISSISSIPPI, WITH DESCRIPTIONS OF NEW SPECIES.

By T. H. Aldrich.

Among a large mass of material collected during the past two years, the following species, principally from Mississippi, are believed to be new. The principal locality, Red Bluff, Miss., is no doubt a local bed, part of the Vicksburg group; but it seems to be rich in peculiar forms, besides having a large number of Vicksburg fossils proper. All are particularly well developed, and in a good state of preservation:

Solecurtus Vicksburgensis, n. sp. Pl. 2, fig. 1. Shell, transversely-oblong; surface, obliquely grooved nearly all over; anterior end, smooth; posterior, with grooves meeting those on the posterior and dorsal margin at an obtuse angle; angular along the umbonial slope; anterior, truncated; posterior, rounded; ventral part, concave, lines of growth showing distinctly; beak, slightly raised, rounded, striated, on the anterior side of the shell. Two indistinct lines run across the center of the shell from the beak to the ventral margin; posterior tooth in left valve prominent. Height, $\frac{5}{10}$ of an inch; width, $1\frac{1}{10}$.

Locality, Vicksburg, Miss.

Only the left valve of the species is known. The interior being filled with matrix, no description can be made.

Murex (Pteronotus) angelus, n. sp. Pl. 2, fig. 2. Shell, oblong, with three spinous varices; whorls convex, seven; spire, elevated; surface, rough, showing three or four revolving lines on the body whorl; spines, channeled to the tips, nearly closed, small sub-spines between the larger ones; aperture, oval; outer lip, ridged; inner lip, reflected; canal, long, longer than the aperture, curving outward. Length, $1\frac{1}{10}$ inches; breadth, nearly $\frac{6}{10}$ of an inch.

Locality, Red Bluff, Miss.

This interesting species belongs to the true Murices, modern species of the group only occurring in Africa and East Indies.

PLEUROTOMA (SURCULA) LONGIFORMA, n. sp. Pl. 2, figs. 10, a. b. Shell, fusiform; volutions, eleven to twelve, convex beneath, subangulated and constricted above; suture, plainly marked; the indented space convex in some specimens, in others flat, and covered with close revolving lines; a prominent line bounding the periphery, sometimes minutely beaded; revolving lines on the lower part of each volution fainter, obsolete on center of body whorl, rather prominent and alternate on the beak, which is long and straight nearly half the length of the shell; lines of growth rather prominent; slit in lip profound (Fig. 10 b). Length, $2\frac{8}{10}$ inches.

Localities, Carson's Creek, Red Bluff, and Vicksburg, Miss.

This species has the form and markings of *Surcula Gabbi Con.* from Texas, but a comparison with the type of that species shows it to be different in the number of whorls, shape of the upper part of the volutions, and general form.

PLEUROTOMA HEILPRINI, n. sp., Pl 3, fig. 15. Shell, short, broadly fusiform, decussated; whorls, eight; surface covered with revolving lines crossed by prominent nodes upon the spire, sculpture rather fine; suture, impressed, bordered by a raised band, which is cut by the longitudinal lines; apex, pointed, the first two whorls smooth; upper part of the volutions concave; body whorl, angulated at the shoulder, cancellated; the angulation and depressed margins giving the shell a twisted appearance; aperture, narrow; canal, short, rather wide, and twisted; sinus, deep, rather wide, trigonal; a slight callosity on the upper part of the columellar lip, which is smooth below; outer lip, thin, wavy from the striations, smooth inside· lines of growth prominent on the body whorl, and the raised lines very numerous. Length, $\frac{7}{10}$ of an inch; breadth, $\frac{4}{10}$.

Locality, Moody's Branch, Jackson, Miss.

Named in honor of A. Heilprin, Esq., of the Philadelphia Academy of Natural Sciences.

PLEUROTOMA ANITA, n. sp. Pl. 2, fig. 3. Shell, bucciniform, elevated, carinate, contracted above the shoulder; whorls of the spire ornamented with a series of longitudinal nodes, crossed at irregular intervals with raised lines; apex, smooth, pointed; sculpture, coarse; body whorl, shouldered, shoulder bordered by a series of several fine tranverse lines between the heavy raised ones; lines of growth, fine and numerous; aperture, oblong-ovate; canal, short, rather open, and slightly twisted; labrum, smooth inside, wavy in outline; sinus, deep, broad, and rounded; labium, smooth, reflected below. Length, $1\frac{1}{10}$ inches.

Locality, Red Bluff, Miss.

This species resembles *P. Heilprini*, nobis, but differs from it by the lack of the constriction of the whorls, its coarser sculpture, and strong nodes upon the body whorl.

TURBINELLA (CARICELLA) RETICULATA, n. sp. Pl. 2, figs. 4, a. b. c. Shell, pyriform, variable, moderately thin, with revolving raised lines covering the whole surface, crossed longitudinally by finely raised lines of growth; lines alternately fine and coarse; suture, impressed; spire, cancellated; apex, decorticated in all the specimens.

Whorls varying from roundly globose (Fig. 4, a.) through the form (4, b.) to a constricted form (Fig. 4, c.), the upper part concave, making the body whorl obtusely angular; base, prolonged, strongly twisted; aperture, oblong; labium, curved, with four equidistant plaits about the center; outer lip, sharp, smooth within. Length, $1\frac{4}{10}$ inches; breadth, variable.

Localities, Red Bluff and Shubuta, Miss.

CASSIS (SEMICASSIS) SHUBUTENSIS, n. sp. Pl. 2, figs. 5, a. b. Shell, rather thin, oblong-oval; whorls six, convex, the surface with revolving lines; suture, distinct; apex, pointed; spire, elevated, the first three whorls nearly smooth, the next two slightly carinate; body whorl, with a sharp nodulous line on the upper part, nodes running transversely, with another finer nodulous line above; center of body whorl, with a strongly raised line, a lesser one above, with fine close set ones between; below the center are four raised lines, with finer ones between; beak, nearly straight, the outer lip

meeting it at an acute angle; aperture, ovate, the revolving lines passing into it; labium, with rugose plaits below, upon a reflected callus; labrum, reflected, with strong plaits in pairs on the edge. Length, $\frac{8}{10}$ of an inch; breadth, $\frac{5}{10}$.

Localities, 200 yards north of railroad bridge below Shubuta, Miss., and also at Red Bluff.

Differs from all other forms by its prominent lines, absence of any varices, only two nodulous lines, and size.

Strombus (Canarium) Smithii, n. sp. Pl. 2, fig. 6. Shell, oblong-ovate, whorls six, longitudinally ribbed and crossed by numerous fine equidistant revolving lines, with alternating finer ones between each; very fine longitudinal lines between the nodes; concave above and slightly shouldered at the suture; suture distinct; apex blunt, smooth; body whorl showing a large rib on the opposite side from the aperture, probably a former lip; aperture oblong; outer lip inflected, smooth inside; inner lip showing the revolving lines on the upper part; a thin callus spreading out over the body whorl; canal moderate, open, slightly recurved. Length, $\frac{7}{10}$ of an inch; breadth, $\frac{4}{10}$.

Locality, Red Bluff, Miss.

Living forms are tropical. Named in honor of Dr. Eug. A. Smith, State Geologist of Alabama.

Scaphander primus, n. sp. Pl. 2, fig. 7, a, b. Shell ovate, with crowded, inequidistant, transverse striæ; spire concealed; aperture large, expanding below, contracted above by the intrusion of the body whorl; outer lip sharp, arcuate rising above the apex; labium with a thin lamina; shell rather narrow above, rounded and expanded below. Length, $\frac{6}{10}$ of an inch; breadth, $\frac{4}{10}$.

Locality, Red Bluffs, Miss.

Triton (Simpulum) Conradianus, n. sp., Pl. 2, fig. 8. Fusiform; whorls nine, rounded, nodosely ribbed; nodes prominent, rounded, and deeply cut by revolving lines; revolving lines impressed with interstices, flattened upon the upper and middle part of the body whorl; on the lower part the spaces and lines are interchanged, the lines being very prominent; first two whorls of the

spire smooth, next six tuberculated; varices very numerous; nodes on the body whorl quite prominent, running lengthwise over the middle; labium dentate, one strong tooth at the upper end, small teeth in the middle, prominent ones on the lower part; outer lip dentate internally, thick; canal recurved, nearly closed, longer than the aperture. Length, $1\frac{8}{10}$ inches.

Locality, Red Bluff, Miss., also at Carson's Ck.

This splendid species resembles *T. Schowalteri* Con., but is distinguished by its size, recurved canal, the absence of the acute lines on the body whorl, and the nodes on the periphery being rounded and longitudinal; rather abundant. Named in honor of the late T. A. Conrad.

BUCCINUM VICKSBURGENSIS, n. sp., Pl. 2, fig. 9. Shell ovate-conic; whorls eight, moderately convex, gradually tapering; surface covered with raised revolving lines sharply defined; strong and fine lines alternating, longitudinally ribbed; ribs numerous, having a number of fine lines between; some specimens showing a regularly cancellated surface, others having nodes at the intersecting points; suture deep, and slightly open; apex slightly mammillated, smooth; spire prominent; body whorl with about ten prominent revolving lines, and an equal number of alternating finer ones; canal short, recurved; aperture one-third the length of the shell; columella striated below; outer lip with 9 to 10 raised lines, stopping short of the edge; margin undulating. Length, $\frac{9}{10}$ of an inch.

Locality, Vicksburg, Miss.

Resembles *B. Mississipiensis* Con., but is broader at base, more closely ribbed, and its volutions much less convex.

CONUS (CONORBIS) ALATOIDEUS, n. sp., Pl. 2, fig. 11. Shell fusiform; whorls ten, slightly convex; suture shouldered, distinct; shell indented below the suture with close set longitudinal lines showing on this part; below, a number of raised lines; apex sharp; body whorl with a large number of close set raised lines on the lower part, a few finer ones alternating; aperture narrow; raised lines stop at the columellar lip, which is slightly sinuous, reflected

at the base, thickened above, outer lip large, almost semi-circular, with a notch on the upper part. Length, one inch.

Locality, Moody's Branch, Jackson, Miss.

This shell at sight would be taken for a *Pleurotoma*. It so nearly resembles *Conus alatus* Edwards from the English Eocene that it may be found on direct comparison to be the same species.

Fasciolaria Jacksonensis, n. sp., Pl. 2, fig. 12. Shell long-oval, solid; whorls seven or eight, convex; surface with numerous revolving lines, and about eight ribs on each whorl; suture deep; apex sharp; longitudinal ribs on spire rounded and prominent, more faint on the body whorl, which is covered with raised lines, alternating with fainter ones; beak short, recurved; canal contracted; aperture oval; outer lip sharp, with revolving lines reaching the edge, plicate within, plications about eight, not reaching the edge; inner lip angulated and toothed where it meets the canal; also three plications higher up; a callosity at the upper end; callus reflected over the body whorl, leaving a slight opening or false umbilicus. Length, one inch; breadth, one-half inch.

Locality, Moody's Branch, Jackson, Miss.

This shell bears a wonderful resemblance to *Urosalpinx cinerus* Say, and may belong to the Murices; it differs, however, in the plications on the inner lip; it is close to *Fasciolaria Moorei*, Gabb from Texas.

Turritella bellifera, n. sp., Pl. 3, fig. 13. Shell turrited, subulate; whorls over fourteen; surface with numerous, prominent, revolving striæ, inequidistant, with a number of very fine lines between; lines of growth indistinct on the upper whorls, increasing toward the aperture; on the last whorl, and sometimes the one next above becoming plicate and leaflike; lines wavy, bent toward the sutures; mouth rotund, oval, longest axis with the shell; shell contracted at the suture; suture indistinct; whorls shouldered on the upper part, bounded by a raised line which is itself divided in some specimens. Columella with a smooth callus spreading out in a semi-circle beyond the aperture Length of part remaining, $3\frac{8}{10}$ inches; breadth, $\frac{7}{10}$.

Locality, Lower and upper beds at Bell's Landing, Ala.

This fine species closely resembles the figure of *T. humerosa* Con., from Piscataway, Md., but on a direct comparison with specimens from the typical locality proves to be quite distinct.

CERITHIUM LANGDONI, n. sp., Pl. 3., fig. 14. Shell subulate; whorls 13 to 15(?); surface cancellated; suture indented; about five prominent revolving lines on each whorl; whorls compressed suddenly at both sides of the suture; longitudinal ribs numerous, prominent, wavy, continuing over the impressed spaces and terminating at the suture; revolving line next below the suture splitting into two on the lower whorls; body whorl carinated; mouth nearly round; canal recurved, short, rather close. Length of that part of the shell remaining, $\frac{7}{10}$ of an inch.

Locality, Red Bluff, Miss.

The aperture in the specimens on hand is not entire, and several whorls are missing from the spire. A very distinct species approaching *C. nassula* Con. The peculiar indentations around the suture give the shell a screw-shaped appearance.

Named in honor of D. W. Langdon, Jr., Assistant on the Alabama State Geological Survey.

TRIFORIS AMERICANUS, n. sp. Pl. 3, fig. 16. Shell, sinistral, small, conical; whorls, nine, striate, covered with revolving beadlike lines; suture, distinct, shell compressed just above the suture, with two lines thereon, a broad, prominent beaded line encircling the whorls just above the center, itself divided in some specimens by an impressed line; apex, smooth, mammillated; shell, slightly shouldered at the suture, it being bordered by an impressed line, body whorl convex, lines of growth giving it a cancellated appearance; canal twisted, one-third length of aperture, not quite closed; mouth, oblong-ovate, about one-fourth the length of the shell; outer lip, sharp, plicate within.

Locality, Jackson, Miss.

This is, I believe, the first species of the genus described from the older Tertiary of the Southern States. It is an exceedingly pretty shell.

FUSUS PEARLENSIS,* n. sp. Pl. 3, fig. 17, a. b. Shell, small, fusiform, with eight whorls, surface covered with prominent revolving ridges and longitudinal folds; suture, deeply impressed; whorls, convex; apex, pointed, smooth, first whorl below also smooth; center of each volution almost carinate; body, whorl with four prominent revolving ridges, nodular, situated on the central part of the whorl, less prominent ones above and below; lines of growth give the shell a pitted appearance; aperture, nearly half the length of the shell; canal, straight, contracted; columellar lip, with a reflected callus and plicate-dentate, its whole length; outer lip, incurved, plicate within. Length, $\frac{6}{10}$; breadth, $\frac{3}{10}$ inch.

Locality, Moody's Branch, Jackson, Miss.

SCALARIA WHITFIELDI, n. sp. Pl. 3, fig. 18. Shell, solid, turrited, lustrous white; whorls, probably six, rapidly tapering, round; ribs, numerous, rather far apart; body whorl with one raised transverse line near the base, microscopic revolving lines between the ribs upon the body of the shell; ribs, very solid, thick, rough on the edges, apparently double on the body whorl, bending toward the mouth at the suture; aperture, round; outer lip, reflected and very heavy, projecting slightly at the base. Length, —? breadth $\frac{9}{20}$ of an inch.

Locality, Red Bluff, Miss.

The apex and part of the spire are missing from the only specimen; this species is remarkable for the absence of all revolving lines but the one at the base of the body whorl.

CASSIDARIA BREVIDENTATA, n. sp. Pl. 3, fig. 20. Shell, oblong-oval, whorls seven; suture, channeled; surface, covered with fine revolving striae; coarser, distant lines upon the body whorl, giving the shell the carinated aspect of the genus; lines of growth fine, a few coarser ones showing on the line of the tubercles; apex, smooth; whorls of the spire carinate and slightly tubercled; a row of upright longitudinal nodes on the shoulder of the body whorl, none below; a single, strong varix on the body whorl; aperture, ovate; inner lip, spread over the whorl, with three plications on

* This may be the species mentioned by Meyer, *Am. Jour. Science*, June, 1885, under the name of *Fusus Boettgeri*, but without discription or figure.

the upper part, smooth in the central part and plicate below; outer lip, reflected, plicate on the inner edge above and below, smooth in the center; canal, narrow, strongly twisted. Length $1\frac{4}{10}$; breadth, $\frac{9}{10}$.

Locality, Red Bluff, Miss.

This species differs from *C. carinata* Lam, in having a single, strong varix. It is lighter in substance. I describe it with reluctance, basing its specific difference principally upon the presence of the strong varix.

Cassidaria dubia, n. sp. Pl. 3, fig. 21. Shell, ovate; whorls, six to seven; sculptured the same as *C. carinata* Lam; nodes, sharp, longitudinal, situated on the shoulder of the body whorl; suture, channeled; whorls of the spire with a circle of nodes, subcentral; outer lip, toothed above and plicate on the whole of the inner edge; inner lip, strongly plicate-costate, its entire length; toothed above. Length, about one inch; breadth, $\frac{7}{10}$.

Locality, Headwaters of Bashia Creek, Clark County, Ala., near Wood's Bluff.

Differs from all other species mentioned in the plications of the aperture. Prof. A. Heilprin (Proc, Acad. Nat. Sciences, 1880, p. 365), in his list of fossils from Cave Branch, mentions a "Cassidaria (fragment), closely allied to *C. carinata* Lam," which is no doubt the species above described.

NOTES ON TERTIARY FOSSILS, RARE, OR LITTLE KNOWN.

By T. H. Aldrich.

Scalaria octolineata Con., Pl. 3, fig. 22. This species was described by Conrad in *Jour. Acad. Nat. Sc.*, 2d Ser., Vol. 4, p. 294, but seems never to have been figured; his description is as follows:

"Turrited, whorls longitudinally costate; ribs, distant, very prominent, laminar; revolving lines, distant, prominent, continued over the right side of each varix, the other side rugose; varices, very prominent; base with a carina. Length about 1½ inches.

Locality, Mississippi, Dr. Spillman."

I have no doubt, the specimen figured here, is the one above described; should it prove new, however, I propose the name of *Scalaria Spillmani* for it. The mouth is broken away as well as the apex, but enough remains to give a very good idea of the species. My specimen was received from Dr. Spillman also, and was found at Enterprise, Miss., probably Jacksonian.

TRITON SUBALVEATUM, Con. J. A. N. S., 2d ser., Vol. I., p. 207; Vol. II., p. 41; f. 1, 2, 8. This Vicksburg fossil is not a *Triton;* it has an indistinct oblique fold upon the labium and a canal; Conrad's figures do not show this.

Mr. Geo. W. Tryon, Jr., in "Structural and Systematic Conchology," Vol. II., p. 124, under TRITON, remarks: "TRITONOPSIS, Conrad. The type is a water-worn specimen, which Prof. Angelo Heilprin, who has examined the shell, declares to be too imperfect to assign to it any reliable characters. Has some resemblance to the section *Cabestana*, like *T. doliarium* L. *T. subalveatum*, Con. (xlvi., 62), Eocene, Vicksburg."

The subgenus seems never to have been characterized. It is used in the Smithsonian Catalogue, 1866. It must be expunged, as the shell is no doubt a *Fasciolaria*, and should therefore be known as *Fasciolaria subalveatum.*

CARICELLA DEMISSA, Con. Among a number of specimens collected at Vicksburg there are several that differ considerably from the description. The shell varies from nearly smooth to an entirely cancellated surface.

CITHARA MISSISSIPPIENSIS, Con. Vicksburg group, described as a *Fulgoraria*, and subsequently made the type of an uncharacterized genus, "*Otocheilus.*" Occurs at Red Bluff, Miss., two inches in length.

Many of the Vicksburg species at this point are much larger and finer than at the typical locality.

PYRULA (PYRIFICUS) SMITHII, Sowb., Pl. 3, figs. 23 a, b. This shell, of which mention is made by Conrad, from New Jersey,

in the older Eocene, occurs at Bell's Landing, Ala., in the Lignitic group, beautifully preserved, even showing the interior nacre. I copy the figure 23a from Deshayes. Figure 23b is a specimen from the Paris Basin. It is a well-known shell of the European Eocene.

Cassidaria carinata, Lam. Pl. 3, figs. 19 a, b. *Cassidaria nodosa*, Dixon. This species may be the same as described by Conrad under the name of *Galeodaria tricarinata*, from Vicksburg. I have a number of specimens in various stages of growth from Red Bluff, Miss.

Deshayes seems to have made several species of the varieties of this shell, founded on the differences in the number of tuberculose revolving lines, but the form of the aperture is precisely the same through all my varieties; the common form has three tuberculose revolving lines upon the body whorl. This is a generic rather than a specific peculiarity, according to Prof. A. Heilprin. The differences in Conrad's description are as follows: "Labrum profoundly striate or costate within; columella with a deposit, and profoundly rugoso-striate throughout." All my forms have the aperture toothed above, smooth in the center, costate below. Figure 19 a shows the largest specimen and the common form.

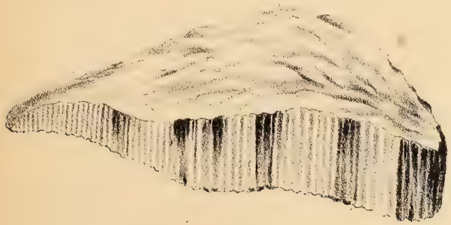
Figure 19 b is the operculem which I was fortunate enough to find with the shell. It is corneus, rounded above, angular below, summit marginal, much smaller than the aperture.

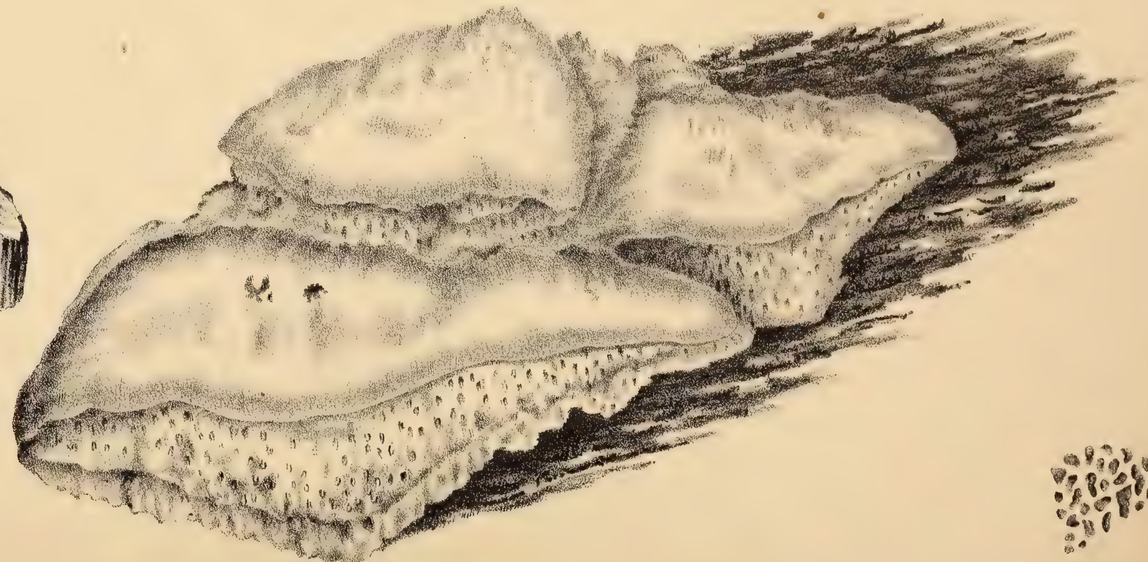
Aspergillum. Large specimens of a species of this genus are in my cabinet, but too imperfect for description, the tubes only being on hand. The largest fragment measures $5\frac{2}{10}$ inches in length and 1 inch in breadth. Locality, Wayne County, Miss., Dr. Spillman. I have also two tubes from the Claiborne sand.

The above notes are given with the hope of correcting some errors, shedding light upon obscure forms and recording the European species mentioned. I propose to continue them in the future with notes on synonomy.

Explanation of Plate II.

Explanation of Plate III.

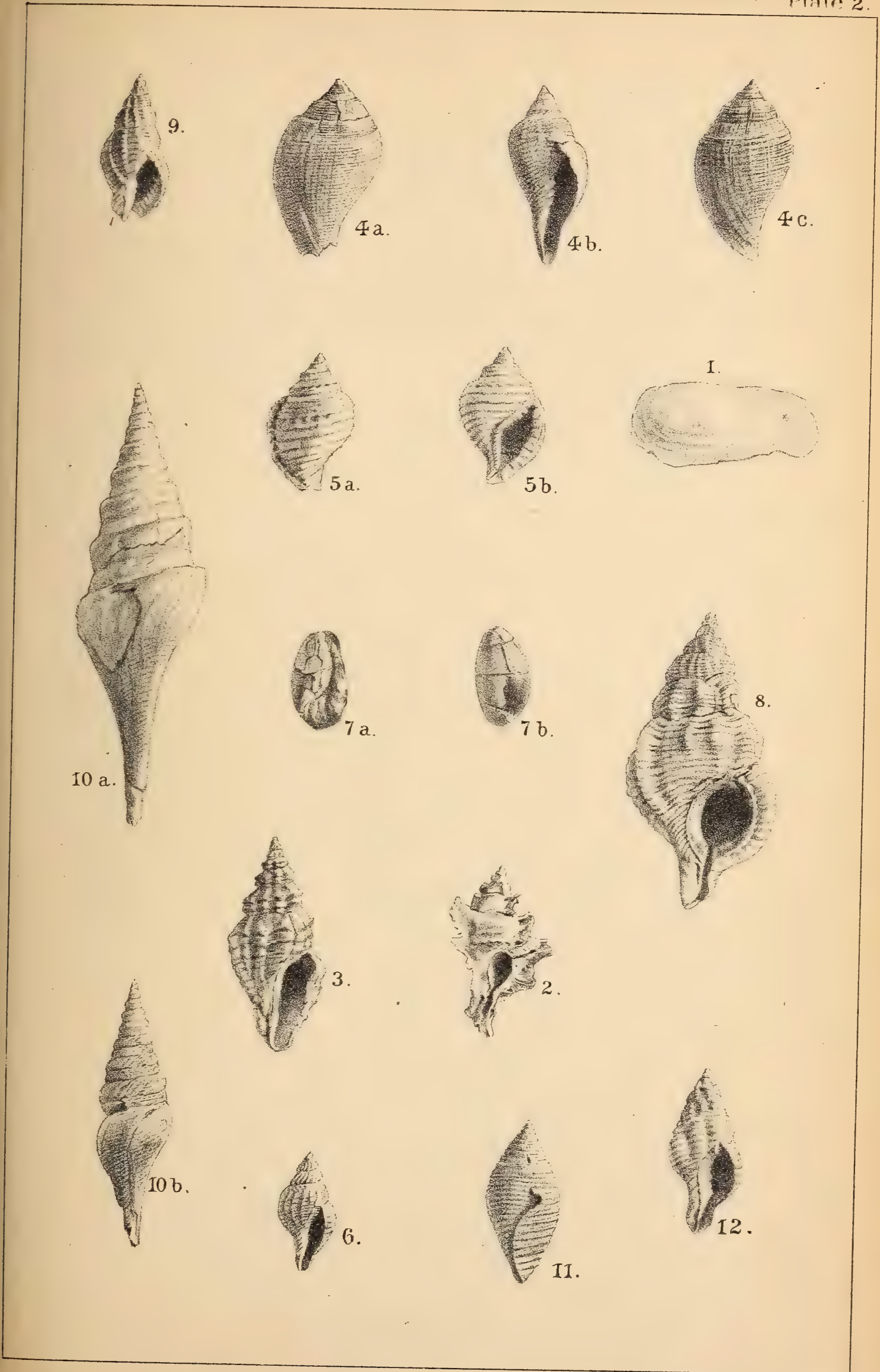




Spores .007 MM.

Pores

Polyporus delectans Peck



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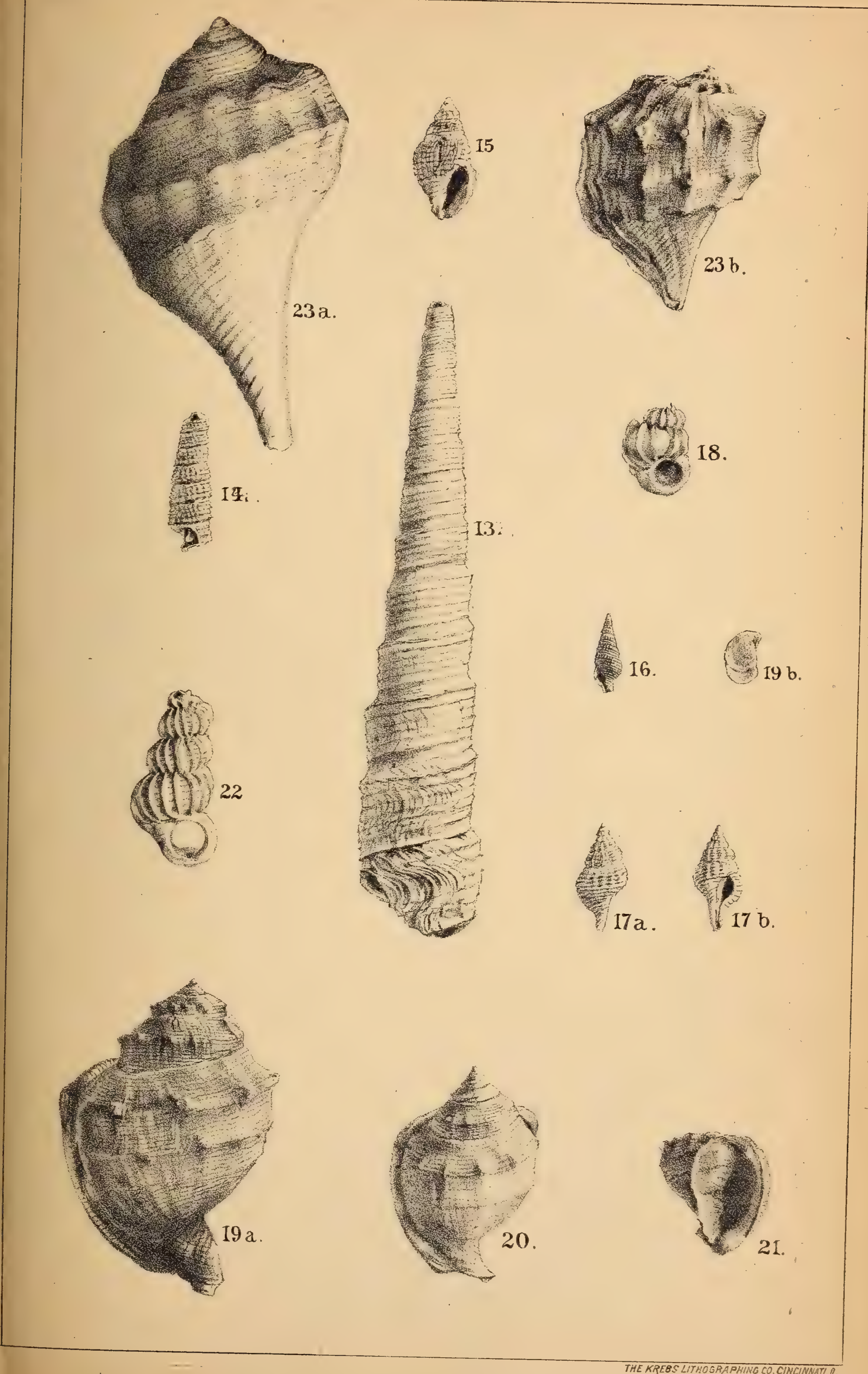

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Publishing Committee.

JAMES W. ABERT. WALTER A. DUN.
RAPHAEL BENJAMIN. WM. HUBBELL FISHER.
JOSEPH F. JAMES.

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Table of Contents.

CALENDAR OF MEETINGS.

Tuesday, October 6.—Business and Scientific Meeting.
Tuesday, October 20.—Executive Board Meeting.
Tuesday, November 3.—Scientific Meeting.
Tuesday, November 17.—Executive Board Meeting.
Tuesday, December 1.—Scientific Meeting.
Tuesday, December 15.—Executive Board Meeting.

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THE JOURNAL

OF THE

Cincinnati Society of Natural History.

VOL. VIII. CINCINNATI, OCTOBER, 1885. No. 3.

PROCEEDINGS OF THE SOCIETY.

Meeting of *July* 7, 1885.

President Harper in the chair, and fourteen members present.

Dr. James A. Henshall and Geo. Schneider were elected to regular membership.

The following papers were read and referred to the Publishing Committee:

REMARKS ON A SUPPOSED FOSSIL FUNGUS FROM THE COAL MEASURES.

By Prof. Joseph F. James,

Custodian Cincinnati Society of Natural History.

On October 19, 1877, Professor Leo Lesquereux read a paper before the American Philosophical Society of Philadelphia, afterward published in Vol. XVII (p. 173) of their "Proceedings," on "A species of Fungus recently discovered in the Shales of the Darlington Coal Bed (Lower Productive Coal Measures, Alleghany River Series) at Cannelton, Beaver Co., Pennsylvania." After referring to a supposed species of fossil fungus described by Lindley & Hutton, in 1831–'33, under the name of *Polyporites Bowmanni*, Prof. Lesquereux calls attention to certain similar fragments found in the Anthracite measures in Pennsylvania, and adds: that "There are in the Tertiary Lignitic of the Rocky Mountains some

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[Note.—Through an oversight the following was omitted from the proceedings of the meeting of June 2.]

Messrs. Karl Langenbeck and H. C. Fithian were elected regular members of the Society.

The names of Dr. James A. Henshall and Mr. George Schneider were proposed for membership.

clay beds associated with coal, wherein are intercallated shaly fragments, colored in concentric zones by penetration of iron in such a way that they exactly represent the appearance of the fossils described by the English Authors. The zones, about two millemetres wide, are of different hardness, and the soft white ones being easily disintegrated, they form a series of alternately elevated and depressed bands, similar to those described as characters of the *Polyporites* of the coal."

Having thus disposed of the only form ever previously referred to Fungi*, he goes on to describe under the name of *Rhizomorpha Sigillariæ*, a specimen found in the Coal Measures of Pennsylvania which he considers a fungus. It was found under the bark of a species of *Sigillaria*, and is described as having an irregularly formed stem, "round, polygonal, elongated and linear, or amorphous," with diverging simple or forked branches, club-shaped toward the ends, or flattened by compression.

Some time since, I read before this Society† a paper on the "Fucoids of the Cincinnati Group," in which I endeavored to show that none of the so-called marine plants found in this locality were of a vegetable nature; but that they are referable either to inorganic causes, such as water washings, or to tracks, trails, Graptolites, or impressions of organisms. It is my opinion that the fossil under consideration has been erroneously referred to the vegetable kingdom; and that, instead, it should be regarded as a burrow made under the bark, where found, by some species of insect.

That it is not a vegetable is rendered probable from the fact that the mycelium of a fungus, which the fossil is supposed to be, is of a character little likely to be preserved. It is liable to decay in a short period, and even the spot it has occupied becomes indistinguishable from the rest of the wood. It is otherwise with an excavation made by an insect. This, living under the bark, eats it away along certain lines, and leaves behind a cavity which remains as a scar, and if the tree under the bark of which it has burrowed be preserved as a fossil, the burrow stands an equally good chance of preservation.

That the fossil considered is a larva burrow, is rendered still more probable when it is remembered that under the bark of living trees, similar excavations are found. Those made by species of *Scolytus* burrowing under the bark of species of Hickory, possess the same characteristics and appearances as the fossil. The main burrow is generally straight, although

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* In the "Bull. of Torrey Bot. Club" for June, 1885, (Vol. XII, p. 64) is a note on a fossil fungus found by Messrs. B. Renault and E. E. Bertrand in the tissues of the nucleus of *Sphærospermum oblongum*, of the Coal Measures. The fungus belonged among the Chytridiaceæ.

† See this JOURNAL, Vol. VII, pp. 124, 151. Oct., 1884—Jan., 1885.

frequently curved; the branches are diverging, generally simple, sometimes forked: are obtuse, club-shaped and flat. A comparison of the figure given by Lesquereux, with one given by Professor C. V. Riley in his fifth annual report as State Entomologist of Missouri, p. 103, will illustrate the resemblances between the fossil and the recent burrow. The burrows made by other species are still more like the fossil.

What now are the prospects of an insectivorous larva living under the bark of a *Sigillaria?* Were there any species living at the time and place where the fossil was found? In looking over a "Catalogue of Palæozoic Fossil Insects" compiled by Mr. R. D. Lacoe, and published in 1883, I find no less than five species out of a total of seventy-two fossil insects were found in the same locality as the fossil fungus (?), and in beds of the same age. As there is every probability that the habits of insects in past ages conform in many respects to those at the present time, it may be considered that they went through metamorphoses then as they do now: that the eggs hatched into grubs, the grubs fed, and then spun coccoons or formed the pupa cases, and finally emerged as perfect insects. There can be but little doubt that the *Rhizomorpha Sigillariæ* is the burrow left under the bark by the grub of some one of the species of insects flourishing at the time of the deposition of the coal.

A specimen of wood recently presented to this Society by Geo. W. Keck, has on it several of these burrows in an excellent state of preservation, and a few remarks as to how they are made may be of interest. Prof. Riley in the report referred to says, that both male and female insects bore into the tree just under the bark. A vertical chamber is excavated in which the female deposits her eggs, numbering from twenty to fifty. When the larvæ hatch, they bore in a horizontal direction, away from the central burrow, each in a distinct track, feeding on the inner bark. The perfect insect, a beetle, issues from a small hole in the bark, and the same cycle recurs. They are very destructive insects, and cause the death of whole groves of hickory trees. In Europe the elm is attacked in the same way. Perhaps in the ancient days insects of similar kinds were just as destructive to the forests, and in some cases have left their burrows to tell the story.

REMARKS ON SOME MARKINGS ON THE ROCKS OF THE CINCINNATI GROUP, DESCRIBED UNDER THE NAMES OF ORMATHICHNUS AND WALCOTTIA.

BY PROF. JOSEPH F. JAMES,

Custodian Cincinnati Society of Natural History.

The rocks forming the strata of the Cincinnati Group are full of markings which have either been neglected entirely, or else have been studied with erroneous ideas of their true nature. These markings are most common at the horizons where the rocks contain tracks and burrows which have been described as Fucoids. These have been shown* to be mostly inorganic in their origin, and while some are deserving of names, others are not. Other markings have also been described, sometimes from imperfect specimens, sometimes with an imperfect knowledge of how they were formed, or what they really represented.

Among the markings which have received attention, there are a number of genera (five) and species (eight) which have been figured and described in the JOURNAL of the Cincinnati Society of Natural History, Vol. II, pages 217 to 222, by S. A. Miller. The author of the paper considers the species he describes to have been made on the "bed of an ocean having no great depth, but where the water was almost motionless, part of the time, and at others very slightly disturbed" (p. 217, 218).

Such a condition of affairs may be considered as nearly impossible. No ocean known is shallow and quiet at the same time, so quiet as not to destroy marks which may have been made in very fine sediment. Some of these markings, as described, are so delicate that the slightest movement of the water would suffice to erase them; and others are of such a character that the movement of water is necessary for their production. Instead, therefore, of regarding them as produced at the bottom of a shallow sea, it would be more reasonable to consider them as having been produced on exposed surfaces of mud, and in such proximity to the water that deposits of mud would preserve them for future ages.

One of these reputed tracks received the name of

ORMATHICHNUS, Miller.

The genus "consists of a single, continuous, beaded track or trail."

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* JOURNAL Cincinnati Society of Natural History, Vol. VII, pp. 124, 151.

One species, *O. moniliformis* was described and figured. The author remarks that it resembles "somewhat the impression made by a small column of *Heterocrinus simplex*, though longer beaded." It was supposed to have been made by a Gasteropod, though there can now be little doubt but that it was really made by a crinoid stem.

On slabs of rock bearing impressions referable to this species, there are often found curious waved and curved lines running parallel with each other, and sometimes covering considerable spaces of the rock. Occasionally at one end of the chain will be noticed a widening out. Here is the first indication of the source of the mark. It has been made by the stem of a crinoid, which, fastened at one end, and resting on the mud, has been moved to and fro by the water, and has thus left a trail. Each one of the divisions of the column has scooped out a depression. The further from the attached end, the wider will be the mark. The interruptions, in some instances, indicate that the stem has only at times touched the mud surface, while at other times the marks having once been made were destroyed by currents of water.

On the slabs containing these marks, fragments of crinoid stems are sometimes found. Often the marks imitate the stem so exactly that it requires close inspection to see their true character. But the real origin of the marks is conclusively shown in a specimen found near Cincinnati and in one found in the upper part of the Group (Clinton county, O.) by Mr. U. P. James. This last specimen is six or eight inches long, of very compact limestone, having on it one of these trails. The trail is about three inches wide at one end, and the center is scooped out into a hollow about half an inch deep. At the lower end is the crinoid stem, or part of it, which made the mark. The hollow is marked with curved parallel lines, each line as far from the next one as are the joints of the column. It is quite evident that the hollow has been formed by the sweeping to and fro of the stem, and the ridges indicate the situation of the joints.

Another of the ill-defined and obscure fossils which have been described, has received the name of

WALCOTTIA, Miller & Dyer.

The genus was described in the JOURNAL of the Cincinnati Society of Natural History, Vol. I, page 39. It was considered to be an annelid. It consists of "long, tapering, rugose, flexuous bodies, worm-like in form." "The fossils taper to a point at one end, and are enlarged at the other, or present the appearance of suddenly bending down and entering the rock."

The authors were uncertain as to the affinities of this fossil, but thought it probable it was the "long lost borer of Silurian Age."

Three species of this genus have been described, viz.: *W. rugosa*, M. & D., *W. cookana*, M. & D., and *W. sulcata*, James. The first of these is represented as a flexuous body with ridges in pairs, one on each side of the body, and forming an angle with each other on top of the body. It seems to be the impression of the under side of the flexible arm of a star-fish, rather than any distinct organism.

The second species, *W. cookana*, M. & D., is smaller, with the ridges less evident, and in no way so marked as the first. It is, apparently, the impression of some portion of a crinoid, either a part of the stem or one of the fingers.

The third species, *W. sulcata*, James, is much larger than either of the others. It is longer, thicker, with a depression running along the centre, and a few obscure markings along either edge. This mark, different from either of the others, seems to be a burrow.

Only a few specimens of these obscure fossils have been found. The figures show no structure whatever, the descriptions make no mention of any. They have but little definite form, and different specimens of the same species present many variations; in fact, no two are alike. Whatever else they may be, it is very questionable if they are the remains of worms, those perishable organisms without signs of a skeleton of any sort which could be preserved; without appendages by means of which they could leave impressions on the mud; without structure which is capable of resisting the process of decomposition. Further, these marks are found on surfaces which have obviously been exposed to atmospheric agencies, and are also in situations where there is the least possible probability of their being preserved from decay. Had they possessed a solid internal framework or appendages likely to leave an impress on the mud, there might be some ground for referring the marks to the remains of worms, or at least organisms. Annelids possess none of these, and as the specimens show no signs of any structure, it is safe to consign the genus with its species to the limbo of the improbable, and wipe from the catalogues three more useless names.

"Notes on the Tertiary of Alabama and Mississippi, with Descriptions of New Species," by T. H. Aldrich. "Notes on Tertiary Fossils, Rare or Little Known," by T. H. Aldrich. Both these papers were published in the July number of the JOURNAL.

The donations for the month were as follows: from G. H. Curtis, two microscopic slides; from F. W. Putnam, two pamphlets; from J. S. Newberry, one pamphlet; from Walter A. Dun, one pamphlet; from Signal Service Officer, "Monthly Weather Review" for April, 1885; from S. T. Carley, three specimens of *Liparis lilliifolia*, and a box of fossils from Sumpter Co., Alabama; from Smithsonian Institution, "Pro. U. S. Nat. Museum," Vol. VIII, Nos. 6 to 11; from Geo. W. Keck, specimen of wood with larvæ burrows; from Jos. F. James, specimens of Holly wood; from Director of the U. S. Geol. Survey, Vol. VI of Monographs; from T. H. Wise, one pamphlet; from A. R. Crandall, nine maps of Geol. Survey of Kentucky; from A. B. Carnahan, one Indian relic.

MEETING OF *August* 4, 1885.

MR. CHAS. DURY in the chair, president *pro tem.*, and ten members present.

The following paper was read and referred to the Publishing Committee:

REMARKS ON THE GENERA LEPIDOLITES, ANOMALOIDES, ISCHADITES AND RECEPTACULITES, FROM THE CINCINNATI GROUP.

BY PROF. JOSEPH F. JAMES,

Custodian Cincinnati Society of Natural History.

In the JOURNAL of the Cincinnati Society of Natural History, Vol. II, page 20, there was characterized by Mr. E. O. Ulrich a genus of fossils under the name of *Lepidolites*. The specimens upon which the genus was founded were obtained near Covington, Ky., in the shales of the lower part of the Cincinnati Group. "They consist," the author says, "of much flattened calcareous bodies, which in their original state must have had, in the type species, a sub-spherical and in the other species a sub-cylindrical form." They were hollow, and the outer surface was covered with small plates or scales over-lapping one another.

L. dickhauti was described as having been flattened from a sub-spherical or sub-pyriform shape, with an indentation at the bottom. The scales on the outside were imbricated, "with the exposed margin rounded, and arranged in concentric lines, crossing each other in a quincuncial manner." "The appearance presented by a specimen that is flattened vertically, is very like that style of ornamental work on watch cases called 'rose-

engine turning.'" "Detached plates have a length that is equal to about three times the greatest breadth, and are somewhat cuneiform in outline, the widest end being that which is exposed." The lower side of each plate is provided with a longitudinal furrow.

L. elongatus differs chiefly from the type in being sub-cylindrical instead of sub-spherical, though the arrangement of the plates is the same.

In his remarks on the possible position of the genus, the author considers that these fossils cannot be referred to the echinodermata, "on account of the absence of openings, or of any series of plates that might be termed ambulacra." He further says that it seems related in certain character to *Pasceolus*, itself of an uncertain position, but considered by some a Cystidian, and by others a sponge.

I propose to show the identity of these two species to a genus of the order RECEPTACULIDÆ, belonging to the sponges.

The genera comprising the order are four, viz: ISCHADITES, Murchison, 1839 (Siluria, p. 697); SPHÆROSPONGIA, Pengelly, 1861 (Geologist IV, p. 340); ACANTHOCHONIA, Hinde, 1884 (Q. J. G. Soc., No. 160, p. 819); and RECEPTACULITES, Defrance, 1827 (Dict. Sci. Nat., t. 45, atlas, p. 68). Though now generally referred to the sponges, the order has been frequently placed with the Foraminifera, but the arguments for and against its position with the sponges must be neglected here, and the student referred to a paper on the subject by Dr. G. J. Hinde, published in the Quar. Jour. of Geol. Soc. of London, Nov., 1884, p. 395 *et seq.*

The genus ISCHADITES was first described by Murchison in 1839, in his "Siluria," p. 697. In the type species the general form varies from ovate to bi-convex or conical; "some are sub-spherical, and others pyriform." (Hinde, *l. c.*, 811.) The central zone is either bulged out, or the contour is rounded from base to summit. The base may be obtusely conical, flattened or concave. The outer surface has a number of plates, thickest in the central portion, but diminishing toward the margins, where they are very thin. They are generally rhomboidal. "The manner," says Dr. Hinde (*l. c.*, p. 812) "in which the spicular plates are arranged on the surface of the organism forms its most conspicuous feature. They are disposed in regular spiral curves which, starting in opposite directions, from the basal nucleus, and extending to the summit, give to the surface the exact appearance of the engine turned case of a watch." "As a rule, the margins of the plates appear to fit closely and evenly to each other, * * * * * but in some cases the upper or front margins seem to be slightly elevated, as if they imbricated over the lower or hind margins of the spicular plates immediately in front."

The points of resemblance between Mr. Ulrich's genus *Lepidolites* and *Ischadites*, are numerous enough to place the former in the latter, yet earlier characterized genus. The sub-pyriform or sub-conical shape, the overlapping plates, and their concentric "engine-turning" arrangement are features common to both. Considering, therefore, that *Lepidolites* was described forty years after *Ischadites*, it seems best to call the two species credited to the former genus

ISCHADITES DICKHAUTI, Ulrich.

ISCHADITES ELONGATUS, Ulrich.

Another genus, the position of which in classification has been a matter of conjecture, was described in the Jour. Cin. Soc. Nat. Hist, Vol. I, p. 92, as

ANOMALOIDES, Ulrich. 1878.

The fossils for which this name was proposed are described as "hollow, compressed, conical bodies." They were found "to have no surface which can be called ventral or dorsal, since they are composed uniformly of elongated, cylindrical, spine-like bodies, which are placed parallel with each other and perpendicular to the surface." These bodies are further described as "club-shaped stems," with their inner ends acutely pointed, while the end showing on the exterior is rounded, and has a minute pit. "The distribution of these club-shaped plates is very regular, being arranged in curved or flexuous transverse and diagonally intersecting lines." In other words the engine-turned arrangement of *Ischadites*.

Now the genus RECEPTACULITES was defined by Defrance as long ago as 1827. Species have been described from the Silurian of America and Australia, and from the Devonian of Belgium. In *R. occidentalis*, Salter (Can. Org. Remains Decade I, p. 43), the arrangement of the plates on the outside of the fossil is described as radiating "in curved lines, crossing like the engine-turned ornaments of a watch." Further, it appears that these lines are caused by the peculiar arrangement of a great number of spine-like bodies, arranged perpendicularly to the surface. That the inside is hollow, and that it is often pressed out of shape from a sphere to a cylindrical body. Fig. 2 (Pl. 10) given by Salter (Ibid), shows the outside of a weathered specimen and it is very similar in appearance to Mr. Ulrich's figure. (Pl. 4, figs. 6, 6 *a b*, J. C. Soc. Nat. Hist., Vol. I).

As there is, then, in *Anomaloides* more resemblance to *Receptaculites* than difference from it; as both possess the spine-like bodies, both are

hollow, and the "engine-turning" arrangement of the plates is the same, I propose that in the future *Anomaloides reticulatus* be placed in the genus to which it properly belongs, and be known as RECEPTACULITES RETICULATUS, Ulrich.

Mr. Geo. B. Twitchell spoke of the Flora of the Tyler-Davidson fountain and was requested to prepare a report for the next meeting.

Donations were announced as follows: from Dr. J. A. Henshall, "Book of the Black Bass;" from J. Kelly O'Neall, tooth of *Elephas Americanus;* from Director of U. S. Geol. Survey, Vol. VII of Monographs; from Smithsonian Institution, Vols. 24 and 25 "Contributions to Knowledge;" from Col. Chas. Whittlesey, two pamphlets; from Chief Signal Officer, Monthly Weather Review, May 1885; from Persifor Frazer, one pamphlet; from Bureau of Education, one pamphlet; from U. S. Nat. Museum, "Proceedings," Vol. VIII, Nos. 12 to 18; plates 1 to 14; from W. Shepard, one Indian stone ax; from Chas. Dury, Black Snake in alcohol and specimens of *Cicada septemdecim;* from J. Mickleborough, specimen of *Oreaster gigas.*

MEETING OF *September* 1, 1885.

PRESIDENT HARPER in the chair, and fifteen members present.

The following papers were read and referred to the Publishing Committee:

THE LIFE IN THE TYLER-DAVIDSON FOUNTAIN.

BY GEO. B. TWITCHELL.

On the evening of our last meeting, in passing the Fifth street fountain, I noticed an Alga growing in great abundance about the edge of the basin.

The unusual circumstances under which the plant was growing led me to make an examination. I collected a small amount and this, under the Society's microscope proved to be so full of life of all kinds that it was thought a full account might prove of interest. This work was given to me. For the past month, with the aid of other members of the Society, I have made observations on this life. These I now offer to the Society.

The collections were almost all made from the large basin and from a small basin under one of the drinking founts. The others yielded but little of any interest. It is quite a noteworthy fact that the faunæ and

floræ of these two basins were almost totally distinct. The large basin yielded (exclusive of diatoms) but one plant—the *Stigeoclonium*—and a great variety of animal life; while in the small basin were found all the other species of filamentous Algæ, a great variety of diatoms, no specimens of *Stigeoclonium*, and but little animal life and that of a low order. This difference was all the more remarkable as the natural conditions, other than that of body of water, in the two basins, were apparently identical.

The highest representative of animal life observed was the little Gasteropod—*Physa heterostrophia*, Say. This creature, I am sorry to say, has since been exterminated. (I mean in the fountain.) The fountain was cleaned soon after my first collection, and since then I have found none. However, they will soon grow again. In among the Algæ were found great numbers of Entomostracans—water fleas—skipping about in every direction. Notable among these, although not very plentiful, were the slender *Cyclops* with their two sacs of eggs. Then the *Cythere* and closely allied *Cypris*, but most abundant and prominent was the *Daphnia*. And surely it is quite right and proper that our modern daughter of the Peneius should take up her abode in our beautiful fountain, rather than in the dirty ditches she so delights in.

Worms were not plentiful: occasionally an *Aquillula* would be seen twisting in and out among the Algæ, and in one collection a lot of Rotifers were found making things lively for the smaller animalculæ.

I was quite astonished to find here a few *Euglenæ*, usually found only in stagnant water. It was not the species that is found in such abundance as to color the water, but the solitary one. In the same collection was found a *Vorticella*. This is by no means all the animal life to be found, but it is all that my objective could make out with any degree of certainty.

Among the plants, as one would naturally suppose, the diatoms were most abundant. Particularly in the small basin; species of *Navicula*, *Nitzchia*, *Pinnularia*, and the graceful *Pleurosigma* were found in great profusion while the *Meridion* and the *Gomphonema* were by no means rare.

Considering the size of the basin and purity of the water the number of species of filamentous Algæ was remarkably large. Fringing the wall of the small basin were masses of *Spirogyra* belonging to two species. Uufortunately the season was too far advanced to find the plant in fruit; but the strongly vegetating, bright green filaments were in the very best condition for showing the beautiful spiral arrangement of the chlorophyl. Here I also found a little mass of *Oscillaria limosa* and a single filament of a larger species. Although to the naked eye by no means an inviting object, yet under the microscope, on account of its wonderful motion, this

dirty green scum becomes one of our most interesting plants. The small basin, strange to say, yielded also desmids of the genera *Closterium* and *Cosmarium*, making a most remarkable flora for a body of water not over two and a half feet in diameter.

We now come to the plant that grew so profusely in the large basin and first drew my attention to the new collecting field. This was the *Stigeoclonium tenue*, Ag. It was found fringing the whole outer wall of the basin, in some places extending over two inches into the water. On the base of the fountain was another mass of what I supposed to be the same although I could not get at it to make a closer examination.

Under the microscope the slimy green substance collected becomes a mass of beautiful branching filaments, made up of many cells. Each cell contains chlorophyl, in vegetating filaments arranged in an irregular stellate mass not quite reaching the ends of the cells. In younger specimens this is not so apparent, while in filaments forming spores the entire cell is filled. I was fortunate enough to see this fruiting. The spores were formed in main filaments frequently between branches that had far outgrown the parent, which probably stopped growing when the formation commenced. The filaments would become constricted at the cell walls and the contents of each cell would form a single zoospore which eventually broke away, leaving the empty cell very delicate and very hard to see. In one collection that I made these spores were forming so rapidly that every dip would bring up hundreds of them. We have, in all, some six or eight species of *Stigeoclonium*, very hard to distinguish, however. I have found but one other in our waters, that in a ditch in Sedamsville.

THE MYCOLOGIC FLORA OF THE MIAMI VALLEY, OHIO.

By A. P. Morgan.

[*Continued from Vol. VIII, p.* 110.]

Genus II. Polyporus, Fr. (Continued).

V. RESUPINATI.

Pileus none, the fungus therefore absolutely resupinate; the pores placed immediately upon the wood or the mycelium, seldom with an interposed subiculum.

A. Pores colored.

a. brown or blackish.

63. P. spissus, Fr. Widely effused, perennial, very hard, immersed, cinereous-brown; the margin very narrow, inflexed. Pores minute, angular, obtuse, entire.

In woods on the underside of hard trunks and branches, such as Hickory; common. Of a hard woody texture and sometimes effused to an extent of many feet; in specimens more than a year old, the annual strata are very distinct. The pores are brown within but the mouths are cinereous; they measure .16 mm. in average diameter.

64. P. obliquus, Pers. Widely ambient, annual, hard, very thick, uneven, pallid then brown and blackish; commonly encircled with an erect crested border. Pores long, oblique, minute, obtuse, angular.

On dead standing trunks of Ironwood (Ostrya); not common. Of a woody texture, very thick and uneven, and in its perfection of the elegant chocolate-brown color that Mr. Berkeley speaks of in the Cuban Fungi. The growth does not decorticate the Ostrya but the long oblique pores penetrate to the wood and seem to involve the bark in their substance. The pores at first are lined with a minute whitish down which gives the pale color to the surface; their average diameter, including the dissepiments, is .18 mm., but the latter are very thick.

65. P. niger, Berk. Effused, hard, rather thick, even, black; the border slightly raised, pubescent, dark brown. Pores minute, round, thin, umber within, the mouth very minutely black-tomentose.

On rotten trunks; rare. Elongated and altogether resupinate except at the very edge, where it is slightly raised, dark brown and pubescent; the substance where it is not quite obsolete, dark brown. Inside of the tubes dark brown but the hynenium jet black.

66. P. unitus, Pers. Effused, even, firm, dry, bright brown; the border thin, depressed, concolorous. Pores very small, thin, angular, acute, unequal.

In woods on old branches; rare. The whole fungus composed of a thin stratum of pores closely adnate to the wood and of a uniform clear brown color throughout. The pores themselves are larger than in the preceding species but the dissepiments are very thin so that the average diameter is about the same, .17 mm.

b. ferruginous or cinnamon.

67. P. ferruginosus, Schrad. Effused, thick, firm, uneven,

tawny, when mature brownish-ferruginous, with a sterile border. Pores medium, very long, subrotund and lacerate, cinnamon.

In woods on trunks and branches; common. The younger specimens are tawny and the older brownish; it is distinguished by its unequal thickness and consequent interrupted and uneven surface. The pores are commonly oblique and very long, measuring .21–.24 mm. in diameter.

68. P. CONTIGUUS, Pers. Effused, thick, firm, glabrous, submarginate, cinnamon when young; the margin villous from the first. Pores rather large, equal, obtuse, entire.

A resupinate form growing commonly on the underside of dead and dry stems of Papaw, (Asimina), is rather doubtfully referred to this species; the same is found on the bark of Ailanthus. The pores are large .38 mm. in diameter, angular, with thin dentate dissepiments.

c. red or purplish.

69. P. PURPUREUS, Fr. Widely and irregularly effused; mycelium mucedinous, flocculose, white, creeping through the surface of the rotten wood. Pores short, minute, unequal, scattered interruptedly or conglomerate, purple-lilac.

On bark and wood of Sugar Maple; rare. Thin and delicate, occurring in straggling patches, with groups of purple pores on the white mycelium. Some of the preserved specimens have bleached out white. It is *P. lilacinus*, Schw.

70. P. ATTENUATUS, Peck. Effused, thin, even, coriaceous, seceding, pinkish-ochre; the border pubescent, whitish. Pores minute, subrotund, thin, acute.

In woods on old trunks; not rare. Effused sometimes for many inches. The minute pores are spread evenly over the very thin whitish subiculum, which is separable from the matrix. The pores might, perhaps, be called subangular as well as subrotund; they measure about .14 mm. in diameter. This is a very beautiful species; it may be *P. vinctus*, Berk.

71. P. RUFUS, Schrad. Effused, coriaceous, thin, adnate, even, glabrous, determinate, dark red. Pores minute, thin, acute.

On old prostrate trunks; common. Specimens which agree with it quite well in color are doubtfully referred to this species; they appear rather humid, and the substance consequently rather fleshy to come under the designation *coriaceous;* the pores too, when fresh, are obtuse, though they may be called *thin* when dry. *P. hæmatodes*, Rostk. is said to be the same thing.

d. yellowish.

72. P. VITELLINUS, Schw. Widely effused, loosely adnate, thick, uneven, soft and fleshy, vitelline, with a byssine margin. Pores very large, elevated, unequal, thin, angular.

On very rotten wood. A soft and fleshy fungus of unequal thickness and large unequal pores. The color is very elegant and persists even in drying; the egg-yellow pervades the whole mass. The long pores vary from round to angular and even sinuous. Strings of yellow mycelium penetrate the rotten wood beneath.

73. P. XANTHOLOMA, Schw. Widely effused, closely adnate, even, smooth, dry; the border rather broad, velvety, yellowish. Pores minute, unequal, subrotund, obtuse, pale yellowish.

Common in woods. Effused often to the extent of many inches or even several feet on the underside of sticks or smaller branches lying somewhat up from the ground and keeping it dry. The border is sometimes "elegantly luteous" and therefore of a deeper yellow than the pores but this is not always the case. The pores at first are pale, maturing into a rich cream-color; they are mostly roundish but vary to oblong and subsinuous; the dissepiments are thick and obtuse; they average .16 mm. in diameter.

74. P. BOMBYCINUS, Fr. Effused, silky-membranaceous, loosely adherent, sordid yellowish, with a cobwebby-velvety border. Pores ample, angulate.

On an old rotten log of Sugar Maple; rare. A very distinct and singular species. It first appears as subrotund byssine spots, soon forming in the center a porose hymenium, these then become confluent into a soft rather thick membrane. The pores originate as little pits sunk in the mycelium out of which they are wholly developed, being at first subrotund, then growing firmer they become angular and sometimes flexuous. The dried specimens have taken on a brownish hue and the dissepiments are very thin, dentate and lacerate. *P. subiculosus*, Peck, seems not much different from the primordial state of this species.

e. cinereous.

75. P. CINEREUS, Schw. Widely effused, adnate, firm; the border narrow, thin white-fimbriate. Pores small, unequal, subrotund, obtuse, cinereous.

In woods on the lower side of old logs; common. The whole of a uniform ashen hue except the minute whitish fringe of the border. The

growing specimens are somewhat moist, but they shrink little in drying and become quite firm. The pores measure about .20 mm. in diameter. It is an elegant species.

B. Pores white.

f. minute, round, obtuse.

76. P. vitreus, Pers. Effused, subundulate, indeterminate, whitish, subhyaline; the mycelium a tough, separable, subcoriaceous membrane. Pores minute, round, long, obtuse, entire.

Upon rotten prostrate trunks of Beech; rare. A very remarkable species, which has given rise to other genera; *Poria vitrea,* Pers.; the sterile leathery mycelium without any pores, *Xylostroma candidum,* Pers. The stratum of long pores is soft as if fleshy; it is often interrupted or the pores collected in nodules. The Xylostroma is usually found between the bark and the wood.

77. P. obducens, Pers. Effused, incrusting, innate, firm, white, formed wholly of the pores. Pores minute, crowded, equal, distinctly stratified, the older strata pale alutaceous.

On the underside of old trunks; common. The first year it consists of a thin white separable stratum of crowded pores, which, however, in drying takes on the pale alutaceous color of the succeeding years. It is rather humid when young and differs decidedly from *P. vulgaris,* which is always dry and inseparable.

78. P. vulgaris, Fr. Widely effused, thin, dry, closely adnate, even, white; the border soon glabrous. Pores firm, crowded, small, round, nearly equal.

On wood of all sorts; common. Consisting of a thin dry stratum of minute pores, sometimes on hard dry wood. The variety *flavus,* Fr., is not uncommon and the *white* and *yellow* sometimes occur in the same specimen; this is probably *P. pulchellus,* Schw. The pores are roundish with rather thick dissepiments; they measure about .16 mm. in diameter.

g. small, angular, acute.

79. P. mucidus, Pers. Effused, rather thick, somewhat immersed, soft, white, becoming pallid; the border indeterminate, byssine. Pores medium, unequal, lacerate, received in a crustaceous mycelium.

Upon old rotten wood; rare. At first soft and somewhat fleshy. Pores becoming thin, angulate and torn, measuring about .20 mm. in diameter.

80. P. mollusens, Fr. Effused, thin, soft, white; the border

byssine, fibrillose-radiating. Pores in the center or collected here and there, small, thin, round, unequal, lacerate, becoming pallid.

Upon rotten wood, leaves, etc. Thinner and much more delicate than the preceding; to be distinguished by its pores scattered in patches upon a byssine mycelium with a fibrillose border.

81. P. VIRIDANS, B. & Br. Effused, crustaceous-adnate, thin, at first white, afterward, when dry, pale green; the margin pulverulent-tomentose. Pores minute, angular, the dissepiments thin.

In woods on the lower side of old trunks; rare. This is a very beautiful species. It is at first and when growing all white, but in drying the pores take on a pale green tint, leaving, however, a pure white sterile border, elegantly puberulent and fimbriate. It is at first a little humid and seems to be furnished with a subcoriaceous subiculum, which is closely adnate to the wood. The thin dissepiments of the pores are in no wise toothed or torn. The pores measure about .18 mm. in diameter.

82. P. GORDONIENSIS, B. & Br. Effused, membranaceaus, very thin, separable, persistently white; the margin shortly fimbriate. Pores minute, unequal, angulate; the dissepiments very thin, fimbriate-denate.

In woods on old trunks of Elm; rare. At first apparently somewhat fleshy, when dry, becoming extremely thin and delicate. The dried specimens scarcely show the elegantly fringed teeth of the pores. It was first found in Great Britain on Fir; it is recorded in the New York Reports by Prof. Chas. H. Peck.

h. large, angular, unequal.

83. P. VAPORARIUS, Pers. Effused, innate; the mycelium creeping in the wood, floccose, white. Pores large, angulate, white, becoming pallid, crowded together into a contiguous, firm, persistent stratum.

On bark and wood of all kinds; common. This is an extremely variable species in its appearance. The pores at first are angular and about .32 mm. in diameter; their dissepiments soon break and the pores become compound and labyrinthiform. In a very oblique position it, at first sight, appears a Hydnum, but the teeth are terete and a close inspection shows they are pores split on one side. There is no border, but a thin white mycelium creeps close in the surface of the wood and bark. The white color soon becomes stained and rusty. *P. papyraceus*, Schw., growing on dead grapevines, is said not to be different.

84. P. TENUIS, Schw. Long and longitudinally effused, forming a thin subseparable white-palish equable membrane, the margin somewhat sterile and whitish. Pores quite large, subflexuous, shallow, pallid.

"On a dead stick." This is given on the faith of Berkeley, in Lea's

catalogue: I have never met with anything I could so refer. The original habitat, given by Schweinitz, is on the fibrous inner bark of Chestnut.

85. P. CANDIDISSIMUS, Schw. Effused; the mycelium, a very thin, bombycine, but separable membrane. Pores very large, at length oblique, and with the membrane pure white.

In woods on the bark of an old Hickory log, effused for many feet. At first, when fresh and growing, quite soft and fleshy; the pores very large and angular, at first shallow, lengthen and become oblique. The pores present an uneven surface, or are grouped in patches upon the firm membrane. It resembles most *P. molluscus*, but the pores are very much larger. The pure white color is very marked.

i. superficial, distant, punctiform.

86. P. CORTICOLA, Fr. Very broadly effused, equable, firm, white or palish; the mycelium interwoven into a naked subcoriaceous stratum. Pores naked, superficial, commonly obsolete, punctiform.

Upon barks. On account of their habit altogether similar, there are embraced under this name many different forms. Perhaps all are only degenerations of other species; the substerile pores differ greatly in the degree of their evolution.

GENUS II.* MYRIADOPORUS, Peck.

Hymenium cellular, porous. Pores of the surface shallow, open; the others imbedded in the hymenium, variously directed, short, closed, inseparable from each other, and from the hymenophora.

The pores do not, as in Polyporus, form vertical parallel tubes, but rather cells or short tubes variously directed, so that a vertical section of the hymenium, as well as a horizontal one, is porous. Fries mentions such a structure in the Elenchus I, 123; he describes it well, as follows: "In hoc contextus tatus *cellulosus*, incompletos poros format, eosque includit, unde totus fungus extus intusque vesiculosus!"

1. M. ADUSTUS, Peck. Resupinate, effused, thick, subcoriaceous, uneven; the subiculum thin, floccose, whitish. Hymenium thick, grayish black externally, varying to whitish internally, substratose; pores or cells minute, roundish, unequal.

In woods on the underside of an old trunk. Effused to the extent of several inches, about 2 mm. in thickness, the hymenium occupying much the larger part of the thickness. The genus is founded upon this species and *Polyporus induratus*, Peck, 31st Report, p. 37, so that at present there are but two described species.

The name of Dr. J. Taft was proposed for membership.

Mr. T. H. Aldrich spoke of the fact of sharks being caught in the fresh waters of Tombigbee river in Alabama, 125 miles from the mouth. The fish were often five and six feet in length.

Mr. Raphael Benjamin considered the fact a strange one, as he had often seen sharks in great numbers in Port Jackson Bay, Australia, and did not know of an instance in which they frequented fresh water.

Mr. A. P. Morgan donated fifty oil paintings of Fungi, 7 x 10 inches, with the remark that they had been painted by Mrs. Morgan, and exhibited in Boston and New Orleans; he now desired to present the same to the Society. The gift was received with applause.

Mr. Jos. F. James, the Custodian, spoke of the meeting of the American Association at Ann Arbor, and exhibited a few plants collected there. He also called attention to a set of thirty-eight photographs of scenery from the West, recently donated by the U. S. Geological survey.

The following amendment to the constitution was proposed by Dr. W. A. Dun: "That Article II of Section 6 of the By-Laws be amended by the addition of the words 'Photography and Meterorology' to the list of sections in the Society." This amendment comes up for discussion at the next meeting.

The donations of the month were announced as follows: from Nelson W. Perry, web of *Tenia zeæ*, from Mexico, (found in a granary of corn); from Director of U. S. Geological Survey, thirty-eight photographs of canon scenery; from Carlos Shepard, one *Pyrula* from mound on the Ohio river; from Chief Signal officer, "Monthly Weather Review," for June, 1885; from U. S. Fish Commission, "Bulletin," Vol. V, Nos. 7 to 21; from Smithsonian Instutition, "Report," for 1883; from A. P. Morgan, fifty paintings of Fungi; from T. H. Aldrich, twenty-four species of shells from New Zealand.

PETRIFIED HUMAN BONES FOUND IN A MOUND NEAR FORT HILL.

By Walter A. Dun, M. D.*

The specimens of bone† I present you this evening are a part of those recently taken from a mound near the earth works at the mouth of the Great Miami river by Mr. Carter Harrison. The unusual condition of these specimens deserves your careful notice.

I. In the first place, the bones are covered with a hard, stony deposit, thickest on the *anterior* surface, but shading off on the lateral surfaces, leaving the posterior surface nearly free from it. This stony material has, in some situations, penetrated the deeper layers and interstices of bony tissues, and caused true petrification—literally speaking; in places, too, this stony coat has reunited, by "stony union," pieces of fractured bone. This deposit consists of carbonate of lime (CaO, CO_2, or $CaCO_3$) mixed with particles of dirt and small pebbles, forming a kind of conglomerate mass, which shows well on one or two rough eminences. On portions of the deposit is a peculiar irregularly grooved and ridged condition presenting *almost* a reticulated, honey-comb appearance.

II. In the second place, the fractured condition of the bones presents interesting features. Laying aside those fractures, obviously produced in exhuming the skeletons and handling them since, it will be immediately seen that quite a number remain, which will be designated as *old fractures.* In closer examination, these old fractures present striking points of similarity: first, the anterior surfaces have borne the brunt of the cause; second, the force has been considerable and, apparently, applied suddenly at first, and thereafter acted continuously; third, the anterior surfaces are depressed, and in places impacted, the posterior being whole or merely fissured.

III. The condition of the bony tissue, itself, where not infiltrated with the carbonate of lime, gives the appearance of considerable age, crumbling quite easily under the finger, with marked absence of organic matter proper to the normal tissue. The calcareous deposit to the osseous tissue is about all that remains.

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*This paper was read before the Society in the Spring of 1880. In view of the fact that the account given relates to specimens in the Society's Museum, it is deemed well to place the paper upon record.—[Editor.]

†These specimens are now in the Museum of the Society.

IV. The details of the history of the excavations are promised the Society by Mr. Robert Brown, Jr., who furnished the necessary funds for it. Yet I take the liberty of placing here a few points which I got from Mr. Harrison in regard to the circumstances surrounding and the position of these skeletons. These points, labor under the difficulty of all "word of mouth," having been twice repeated, with considerable time intervening for play of memory, and lack the exactness of notes taken on the spot. However, if there has been no mistake, the appearances indicated that a vault occupied a position near the centre of the base of the mound; in this vault two complete skeletons were found laying on their backs, or quite nearly in that position, covered with pieces of rough, partially burnt limestone.

V. Having thus far considered the facts as they appear, the next endeavor will be to explain them, and not only account for these various phenomena, but connect them into a series, and show the order of their occurrence, and how their condition is due to natural causes acting on them and their immediate surroundings. Let us assume, then, that this mound was built over these bodies—how built? Probably in the usual way in mounds of similar character: first, the body placed in position, then the vault built around it and then the mound erected over it. In this instance the bodies were placed, likely, exactly where found, with the bones in a *whole* condition and covered with flesh. I do not think the fractures were produced before death, because quite a number of other bones of the same lot were crushed in similarly from the anterior surface, and even the upper part of the tibia, protected posteriorly as it is by soft parts, could not be so mashed and driven in anteriorly during life when the soft parts form such an unresisting base. The bones then were whole and covered with flesh; here time is required in the story. The flesh decays and at last is all gone; the bones begin to go, when some support of the vault has decayed and the stony roof falls upon the skeleton with sudden force, the bones are broken. Where? How? Broken on the anterior surface, for this surface is turned up, and consequently gets the shock. The surface, too, is cracked and driven in or the bone broken in pieces. The stony roof having thus fallen with a shock on the skeletons, it finds a resting place on them, and in turn is pressed on by dirt above. Degeneration of the bony tissue continued, but the constant pressure served to keep the splintered fragments together; there is room here for a difference of opinion in regard to the nature of the application of the force. It might be claimed that this fractured condition could result from pressure applied

continuously, as by the mere weight of the stone and earth over the skeletons. However, it must be remembered that a cubic inch of human bone will resist the crushing force of five thousand pounds, and that the dirt over a bone in a mound fifteen feet high would not weigh that much. It might be said that these bones had undergone considerable decay of animal matter and material weakening, and that a stone of some square foot or more surface, with the earth above, might press on a small area of bone tissue and thus cause the condition found. Admitting such a possibility, the condition itself is better satisfied by suddenly applied force, at first producing the transverse fissured fractures and then impacting in places in time, by constantly acting. Another point in this connected series of events relates to the deposit of carbonate of lime over the anterior and lateral surfaces of the bones. The deposit resulted from the water holding carbonic acid gas in solution dissolving the hydrate and carbonate of lime converting the hydrate into the carbonate, and dripping from the rocks above on the bones below, penetrating or soaking into the bones, the water then escaping leaving the salt of lime behind in the form of deposit on the bones, in a way similar to the formation of stalactites or stalagmites. That this deposit occurred after the fracturing, is shown by the deposit uniting the fractured fragments in some places. The peculiar grooved and ridged condition of the deposit on the bones, at first seemed to be caused by roots favoring the deposit in some places and hindering it in other places, yet I hardly think this is sufficient. This accounts then for the deposit, its nature, its place on the anterior and lateral surfaces, its relative place in the series of events; much could be added on the apparent age of these bones, yet I think enough has been said in this hasty review.

To recapitulate then: we have a dead body in a vault, time and natural causes produce decay, the falling in of the vault fractures the bones, and last, a stony deposit covers and petrifies them. Such seems to be the history of these petrifactions, yet minds see the same things in different lights. The specimens are before you inviting attention and study, and I shall be glad to alter or amend my present views when fact or the wisdom of age and experience can reasonably demand it.

CATALOGUE

OF THE

BOOKS AND PAMPHLETS

IN THE

LIBRARY

OF THE

CINCINNATI SOCIETY OF NATURAL HISTORY.

COMPILED BY

JOSEPH F. JAMES,

Custodian and Librarian.

The following Catalogue embraces the books and pamphlets in the Library of the Cincinnati Society of Natural History. As much valuable and technical matter in science is now and has been published in the Journals and Transactions of Societies, full series of these are valuable for Scientific Libraries of reference. This Catalogue will show many defects in this direction, but these defects are being constantly remedied. New names of Societies are gradually being added to the exchange list of the Society. Most of the Academies and Societies in the United States and many of those in Europe now send their publications regularly to the Library. A large part of the scientific documents published by the Government are also sent regularly, and by these two means alone the Library is rapidly increasing in size and value. It is desirable to complete as far as possible the sets of Transactions and Proceedings of Learned Societies, and those Societies not already in correspondence with the Library, are solicited to open communication with the person in charge. Extras from authors are also desired. One of the objects of this JOURNAL is to exchange with other Societies, and as quite a number of the previous volumes are still on hand, they will be gladly exchanged for volumes wanting in sets and for scientific books and periodicals. Societies from all countries which desire to exchange publications are requested to correspond with the Librarian as below.

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108 Broadway, CINCINNATI, O., U. S. A.

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Table of Contents.

CALENDAR OF MEETINGS.

Tuesday, January 5.—Business and Scientific Meeting.
Tuesday, January 19.—Executive Board Meeting.
Tuesday, February 2.—Scientific Meeting.
Tuesday, February 16.—Executive Board Meeting.
Tuesday, March 2.—Scientific Meeting.
Tuesday, March 16.—Executive Board Meeting.
Tuesday, April 6.—Annual Meeting.

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CATALOGUE OF BOOKS AND PAMPHLETS.

[CONCLUDED.]

Packard, A. S., Jr. New Phyllopod Crustacea from the West. (Pamph.)

—— —— Notes on Phalænidæ and Pyralidæ in British Museum. (Pamph.)

—— —— North American Phalænidæ. . (Pamph.)

—— —— Record of North American Entomology for years 1869 to 1873. Salem.

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—— —— Ashburner, C. A. Geology of McKean County. With Atlas. 1882. (2 vols.) R

—— —— —— —— Report of Aughwich Valley, &c. 1878. F

—— —— Carll, J. F. Geology of Oil Regions. With Atlas. 2 vols. 1880. I 3

—— —— —— —— Oil Well Records and Levels. 1878. I 2

—— —— —— —— Report of Progress in Venango County District. 1875. I

—— —— Chance, H. M. Report of Progress in Butler County, and in Beaver, Lawrence and Mercer. 1879. V

—— —— Dewees, J. H. Report of Progress in Juniata District. 1878. F

—— —— Frazer, P., Jr. Classification of Coals. 1879. M 2

—— —— —— —— Geology of Lancaster County. 1880. 2 vols. C 3

—— —— —— —— Report of Progress in York, Adams, Cumberland and Franklin. 1877. C 2

—— —— —— —— Report of Progress in York and Adams. 1876. C

—— —— Fulton, John. Report of Progress in Bradford and Tioga Counties.—The Coking of Bituminous Coal. G

—— —— Genth, F. A. Preliminary Report on Mineralogy of Pennsylvania. 1875. B

—— —— Hall, C. E. Catalogue of Geological Museum. Part I. 1878. O

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—— —— Lesley, J. P. Historical Sketch of Geological Explorations in Pennsylvania. 1876. A

—— —— —— —— Map and Profile along Slippery Rock Creek. 1875. J

—— —— —— —— Notes on Dolomite Limestone. 1879. M 2

—— —— —— —— Notes on Comparative Geology of North-eastern Ohio and North-western Pennsylvania, and Western New York. 1875. I

—— —— Lesquereux, Leo. Atlas to Coal Flora of Pennsylvania. 1879. P

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—— —— Lucas, D. Jones. Map and Profile of Levels through Butler, Armstrong and Clarion Counties. 1875. J

—— —— McCreath, And. S. Determination of Carbon in Iron or Steel. 1879. M 2

—— —— —— —— Report of Progress in Laboratory. 1875. M

—— —— —— —— Second ditto. 1879. M 2

—— —— Platt, Franklin. Geology of Blair County. 2 vols. 1881. T

—— —— —— —— Fire Brick Tests. 1879. M 2

—— —— —— —— Report of Progress in Bradford and Tioga. G

—— —— —— —— —— in Clearfield and Jefferson district. H

—— —— —— —— Special Report on Coke Manufacture. 1876. L

—— —— —— —— Utilization of Anthracite Slack. 1879. M 2

—— —— Platt, F. and W. G. Report of Progress in Cambria and Somerset Districts. Parts I and II. H 2 and H 3

—— —— —— W. G. Report of Progress in Armstrong County. 1880. H 5

—— —— —— —— —— in Indiana County. 1878. H 4

—— —— Prime, Fred., Jr. Report of Progress on Brown Hematite. 1875. D

—— —— —— —— The Brown Hematite Deposits of Lehigh County. 1878. D 2

—— —— Randall, F. A. Observations on Geology around Warren. 1875. I

—— —— Sherwood, And. Limits of Catskill and Chemung Formations. G

—— —— —— and Platt. Geology of Lycoming and Sullivan Counties. 1880. G 2

—— —— —— —— Geology of Potter County. 1880. G 3

—— —— Stevenson, J. J. Report of Progress in Fayette and Westmorland Districts. 1877. Parts I and II. K 2 and K 3

—— —— —— —— —— in Greene and Washington Districts. 1876. K

—— —— White, J. C. Geology of Lawrence County. Q 2

—— —— —— —— Report of Progress in Beaver River District. 1878. Q

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—— —— —— Proceedings of Tenth Anniversary of Jan. 27, 1885. (Pamph.)

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PROCEEDINGS OF THE SOCIETY.

Meeting of *October* 6, 1885.

President Harper in the chair and sixteen members present.

The following names were proposed for regular membership :

Chas. H. Allen. Jr.
Wm. Archer.
Wm. B. Burnet.
H. E. Bonshur.
Geo. Bullock.
Stephen S. Coles.
A. J. Carson.
John B. Clunet.
E. J. Carpenter.
W. C. Fiedeldey.
Prof. Thos. French.
John R. Froome.
Herman Groesbeck.
Telford Groesbeck.
Clarence Gilmore.
C. J. Harcourt.
D. W. Huntington.
J. W. Innes.
W. D. Innes.
Rankin D. Jones.
E. B. Johnson.
Chas. H. Kellogg. Jr.
H. N. Kitchell.
T. H. Kelley.
Nicholas Longworth.
Edmund Miller.
Geo. W. McLaughlin.
Geo. W. Pohlman.
L. M. Prince.
A. D. Smith.
Chas. H. Short.
Samuel W. Skinner.
Nelson Sayler.
Wm. Schultze.
John L. Stettinius.
Percy Thorpe.
H. H. Vail.
John Wiggins.
Harry Woods.
Jacob Workum.
John Yoakley.

Dr. J. Taft was elected a regular member.

The Amendment to add to Section 2 of Article VI of the By Laws, the words "Photography and Meteorology," came up for discussion.

In this discussion, Doctors Dun, Langdon, Young, and Heighway, and Mr. E. S. Comings took part. Dr. Young opposed the amendment, but the majority of the members present favoring it, it was carried.

Dr. O. D. Morton exhibited a "Gold Beetle" from Ceylon.

Mr. W. H. Knight showed a specimen of steel rolled to $\frac{1}{300}$ of an inch in thickness. He inquired if any member could state how fine a line could be seen by the naked eye.

Dr. A. E. Heighway, Jr., stated that rulings on glass $\frac{1}{50000}$ of an inch apart could be seen.

Donations were announced as follows : From Smithsonian Institution, "Proceedings of United States National Museum," Vol. VIII, Nos. 19 to 31, and plates 15 to 19, 21, 22, 23. From Department of Interior, "Bulletin No. 27 of United States National Museum." From Western Reserve Historical Society, "Publication No. 66," July, 1885. From Chief Signal Officer, "Monthly Weather Review," July, 1885. From Mrs. M. C. Morehead, 20 species of marine Shells. From Prof. R. B. Warder, "Report of Indiana State Board of Health" for 1884. From George F. King, specimen of Feldspar Pseudomorph.

MEETING OF *November* 3, 1885.

PRESIDENT HARPER in the chair and nineteen members present.

The following papers were read and referred to the Publishing Committee:

REPORT ON MOUND EXPLORATION IN GREENE COUNTY, OHIO.

BY WALTER A. DUN, M. D.

About the middle of August, 1876, in company with Mr. T. J. Brown, now editor of the *Waynesville Chronicle*, I aided in exploring a mound in the Miami Valley, in Greene county, just north of the Warren county line. This mound was situated in a cleared stubble field which had been under cultivation for more than forty years. Between the constant plowing and rain the height of the mound had been considerably reduced, and the line of demarcation between the base and the original soil of the field in which it was situated was rendered very indistinct. By the best measurements we were able to make, the dimensions were as follows: Height five and one-half feet; diameter at the base sixty feet. We excavated a hole from the summit, ten feet long in a north and south direction, and four feet wide. On the very surface we found a barbed arrow point, similar to those which were found in the Deercreek mound.* Twenty inches below the surface an unfinished flat slate instrument was found, about five inches long by one inch wide with a wide rounded middle, and rounded edges. This instrument was not polished smoothly, but showed the long scratches of the material used to shape it. Charcoal and ashes in quantity surrounded with burnt clay, denoting a fire at that point, were found at the depth of four and one-half feet. A beautifully shaped arrow point was found at the depth of five feet resting upon the soil on which the mound was originally built. In the course of excavation one or two thin layers of sand were passed through. On one side of the hole were found undoubted traces of a previous opening. Mr. Brown assured me that the former owner of the place died a few years ago at an advanced age, and that he had told him that it had never been opened. The excavation which was made previous to ours was made a long time back because the earth which had been thrown back was packed as hard as any of the mound earth.

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* See JOURNAL of the Cincinnati Society Natural History, Vol. VII, No. 4, Page 194.

In connection with this report, I wish to report upon the result of the excavation and examination of a number of graves situated on a bluff along the banks of the Scioto river, a mile or two below Yellowbud, in Ross Co., Ohio, which I investigated in July, 1876. There were fifteen or twenty of them scattered through a ten acre cornfield and watermelon patch. They were all circular, about twenty to twenty-five feet in diameter and about fifteen inches high. They were composed of a yellow sandy soil, differing very markedly from the black soil of the field, and in that portion of the field planted in melons, could be easily recognized by the difference in color. A number of these were examined a few days before I arrived, and copper, mica and stone ornaments were taken from them. Small pieces of mica with holes drilled in them, and many mica flakes were picked out of the loose earth of these previous excavations by me on my arrival. Copper beads and ornaments with many slips of mica and stone ornaments were shown to me as coming out of these graves. There were quantities of human bones taken out and found lying around loose. I found these hard and strong, and so firm and perfect that I could hardly bring myself to the belief that they dated back to the recent Indians. I examined a number of these graves in which I found nothing but human bones in a tolerable state of preservation. So far as I could learn, no articles of European make were ever found in these graves. I have alluded to these graves because they are apparently the beginning of mounds constructed recently, or else used as places of interment by the recent Indians. From my observations I would say they were constructed by our late Indians. Further than that, this locality is only a few miles north of "Mound City," that circular enclosure filled with so many mounds and the source of so much of the results of Squier and Davis' investigation. The mounds described by them were nearly all small, and the variations in size from those they report and those I now tell you about are so slight as to make one question the fact as to whether those of Mound City were not really Indian graves. It will also be remembered that the finest pieces of sculpturing, pipes, etc., which Squier and Davis describe, came from Mound City, so that this strikes a blow at once at the division of Mound Builders and Indians into separate races. I am compelled to say that I have long believed there is a difference, and that I am not yet convinced that there is not a difference. That the Mound Builders should be connected in some way with some of the people scattered from Alaska to Patagonia, and all called Indians, I will admit, but I do not believe we have proved them to be identical with our recent North American Indians, and there are numerous reasons to make me think they are not identical.

In answer to an inquiry, Dr. Dun stated that one of the reasons for assuming a distinction between the modern Indians and the Mound Builders, was the mathematical knowledge displayed in the construction of the mounds and earthworks, as well as the condition of mound-builder bones, as compared with Celtic remains of a known age in Europe.

Mr. J. R. Skinner stated that Col. Chas. Whittlesey had concluded from a study of ancient remains that thirty inches was probably the standard of measure of the Mound Builders.

OBSERVATIONS ON THE PERIODICAL CICADA.

By Walter A. Dun, M. D., M. R. C. S.

I desire to present to your notice a few observations which I recently had the opportunity of making on the Seventeen-year Locust in this locality.

The first place of observation was at Lindenthor, the residence of Dr. E. Williams, situated on the top of the hill range on the north side of the Ohio river, a couple of miles from the centre of the city. The locusts began to make their appearance there on Friday, May 28th, but only in small numbers. On Friday evening, immediately after a rain storm, which moistened the ground considerably and possibly aided the locusts to escape, they began to emerge from the ground in large numbers, and crawl to the trees. It is interesting to note the fact that they crawled up the tree often to as great a height as forty feet, and upon this Friday evening, sought the under surface of both limbs and leaves, where their shells were found the following morning. During Friday night and Saturday morning they emerged from their shells and remained about in a quiet way on the trees, apparently unable to make any exertion. Saturday, Sunday and Monday evenings, May 29th, 30th, and June 1st, respectively, similar hordes made their appearance, always late in the afternoon, and mostly they were shell free before morning. On these three later days, none of them being rainy, they never sought the under side of the leaves and boughs, but seemed always to seek the upper surfaces. Upon Tuesday, June 2d, a smaller quantity appeared. I left on Wednesday, so can not say anything about their subsequent coming there. Sunday, May 30th, they were first heard and their presence in force certified to, by the peculiar hum which began about sunrise and grad-

ually increased. I returned to Lindenthor June 18th, and found that the locusts were still there in a small quantity but that their hum was feeble. Quantities of wings and pieces of locusts could be found everywhere. Upon June 21st I was there again, and they had entirely disappeared. The new wood, which had their eggs deposited in them, was dying, and the beech trees seemed to have been specially selected. The limit of duration at this point was twenty-four (24) days. I observed the locusts at Middletown, Franklin, Miamisburg, and Dayton, and could hear their hum all along the C. C. C. & I. R. R. at stopping stations upon the afternoon of June 4th. At Dayton I saw them in quantity, but mostly on trees outside the town. I was told on Sunday, June 7th, that they had been there about a week.

Dr. G. S. Franklin, from Chillocothe, whom I met at Dayton, told me that these locusts abounded in Ross county and made their first appearance there during the last day or two in May. From Dayton I went northward, noting the locusts in Clark county, and arrived at Mechanicsburg, Champaign county, June 8th. The locusts had just begun to make their appearance there on that day. I staid in the north part of Madison county some days after that date before the locusts made any perceptible noise. The difference between their appearance here and there, being about 100 miles in latitude, seems to be marked by a variation of from ten days to two weeks. In fact, when I left there, June 16th, their noise seemed about as loud as that which I had heard in Cincinnati June 2d and near Dayton June 7th. While up in the county I made several trips in the country about, and found the locusts throughout Madison county, and in the eastern part of Champaign. I note in "Science" June 26th, 1885, that Prof. Riley gives the distribution to "The Periodical Cicada" in Ohio, as Green, Franklin, Pike, Columbiana and Miami counties, and the vicinity of Toledo.

To this list I desire to add the following: Hamilton, Butler, Montgomery, Clark, Madison, Champaign and Ross. I trust others in this society may be able to extend the district or aid in mapping it out correctly.

CEPHALOPODA OF THE CINCINNATI GROUP.

BY PROF. JOSEPH F. JAMES,

Custodian Cincinnati Society of Natural History.

The class CEPHALOPODA is represented in the rocks of the Cincinnati Group as exposed in this vicinity by six genera. Thirty-seven species and two varieties have been catalogued as found in the Group. The number given by the present writer is thirty-one species, which seem to be well characterized, two new species being described. The genus *Orthoceras* is the largest and has thirteen species. *Endoceras* and *Cyrtoceras* come next with five and six each. *Lituites* with four, *Colpoceras* with one and *Gomphoceras* with two. All but four of the species belong to the straight, longicone shells, the four species of *Lituites* being the only coiled ones.

The two orders into which the class is divided are best distinguished by the absence or presence of the external shell. All those species of which remains have been found in this locality were provided with an external shell, generally straight, divided into chambers called septa, each of which is connected with its neighbor by means of a tube known as the siphuncle. The animal lived in the outer chamber of the shell and formed a wall across the one behind it, in which it had before resided. The *Nautilidæ* or Nautilus Family is the only one now living of this order, the other two families, *Orthoceratidæ* and *Ammonitidæ*, being known only by fossil representatives.

Of the three families the *Orthoceratidæ* is the oldest, having representatives well developed in the lowest fossil bearing rocks. The *Ammonitidæ* is most common in the secondary formations, particularly the Cretaceous, Jurassic and Liassic, while the *Nautilidæ* ranges from the Lower Silurian age to modern times. Some species of *Orthoceras* attained a length of six feet, and some *Ammonites* were three feet in diameter.

Ammonites did and *Nautili* do float with the shell down and the tentacles expanded on the surface of the water, but creep on the bottom with the shell raised on the back. *Orthoceras*, on the other hand, is supposed by Woodward to have swum in a perpendicular position, head downwards. Whether they crept on the bottom with a six-foot tower on their backs can not now be determined.

It has long seemed to the writer a remarkable fact, that, in spite of the amount of palæontological work done by innumerable writers, so few attempts have been made to collect the scattered descriptions and render

them easily accessible to students. In the present paper the original descriptions of all the species have been consulted, and whenever possible, of the genera also. These last are often particularly difficult to find, but are, at the same time, of special importance to the student. There can be but little doubt but that many synonyms have been made, because of the inability to have all the descriptions together to compare. Others have resulted from considering small and individual differences as being worthy of specific rank. Still others from the fragmentary condition of the specimens described. All zoologists are aware of the variations produced in animal forms by varied conditions. But in geological studies these individual variations do not seem to be considered. Descriptions are made from single and often imperfect specimens. The occurrence of a fossil in another stratum has been thought, if there is the least variation, sufficient for a new name. While if found in another country it is seldom regarded as identical.

The present paper is offered as a contribution toward the complete collection of descriptions of the fossils of the Cincinnati Group. At the close of it will be found a brief bibliography of the works referred to.

Order CEPHALOPODA.

Family ORTHOCERATIDÆ.

Shell straight or curved; conical, or swollen at the chamber of habitation; siphuncle eccentric or central.*

SYNOPSIS OF GENERA.

Shell straight; conical; siphuncle mostly small and dilated between the chambers. ORTHOCERAS, 1.

Shell straight; conical; septa depressed on one side, arched on the other. COLPOCERAS, 2.

Shell straight; conical; siphuncle large, marked or ridged by the septa. ENDOCERAS, 3.

Shell fusiform or bottle-shaped. GOMPHOCERAS, 4.

Shell curved, or partly involute. CYRTOCERAS, 5.

Family NAUTILIDÆ.

Shell planorbiform; sutures simple; whorls (in our species) in contact. LITUITES, 6.

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*It should be understood that this definition is intended to cover only the species of this Group.

Genus I. ORTHOCERAS, Breynius. 1732.

De melonibus petrefactis montis Cármel. Miller, 1875, Cin. Quar. Jour. Sci., II, 124.

Shell conical, straight; greater part of posterior end traversed by convex, transverse septa; transverse section circular, oval or more or less triangular; siphuncle cylindrical, or dilated between the chambers, varying in position from the centre to the outer margin; surface smooth, or longitudinally, or transversely lined.

KEY TO SPECIES.

Septa distant; siphuncle eccentric. *O. amplicameratum*, 1.

Septa approximate; siphuncle varying in position. *O. dyeri*, 2.

Siphuncle central; surface smooth. *O. mohri*, 3.

Surface finely striated transversely. *O. junceum*, 4.

Siphuncle eccentric; surface with transverse lines. *O. transversum*, 5.

Siphuncle lateral; surface with obscure, longitudinal ridges. *O. ortoni*, 6.

Surface with profoundly wrinkled longitudinal lines. *O. anellum*, 7.

Siphuncle sub-central; septa annulated, concave. *O. annulatum*, 8.

Surface with low, rounded, longitudinal ridges. *O. turbidum*, 9.

Siphuncle cylindrical; shell semi-cylindrical. *O. hindei*, 10.

Edges of septa raised; narrow, raised, longitudinal line along one side of shell. *O. duseri*, 11.

Shell surrounded by two tubes; outer tubes without septa. *O. carleyi*, 12.

Siphuncle expanded into bladder-like rings at septa; surface marked by undulated, thread-like, longitudinal lines. *O. tenuifilum*, 13.

1. O. AMPLICAMERATUM, Hall. 1847.

(Pal. N. Y. I, 205. Pl. 51, figs. 1 *a–g.*)

Teretely cylindrical, extremely elongated, very gradually tapering; *septa* very convex, *distant; siphuncle eccentric*, small; section circular; surface unknown.

Locality: Cincinnati, Lebanon, O.

The septa in this species are quite large and distant. It is easily recognized by this character and by the very gradual tapering.

2. O. DYERI, S. A. Miller. 1875.

Cin. Quar. Jour. Sci., II, 125, fig. 11. Jour. Cin. Soc. Nat. Hist., III, 236, Pl. 7, fig. 7.

O. meeki, S. A. M., Cin. Quar. Jour. Sci., II, 126, fig. 12.

O. byrnesi, S. A. M., Ibid., II, 126, fig. 13. J. C. S. N. H., IV, 319, Pl. 8, fig. 8.

O. fosteri, S. A. M., Cin. Quar. Jour. Sci., II, 127. J. C. S. N. H., IV, 319, Pl. 8, figs. 7, 7*a*.

O. cincinnatiense, S. A. M., Cin. Quar. Jour. Sci., II, 127. J. C. S. N. H., IV, 319, Pl. 8, figs. 5, 5*a*.

O. halli, S. A. M., Cin. Quar. Jour. Sci., II, 128, fig. 14.

O. harperi, S. A. M., Ibid., II, 128. J. C. S. N. H., IV, 319, Pl. 8, figs. 6, 6*a*.

Shell medium size or large, gradually tapering; septa arched, distant from one-fifth to two-ninths the diameter of the shell; *siphuncle subcentral or eccentric, varying in position* and in size; outer shell unknown.

Locality: Cincinnati and Warren and Clinton Counties, O.

The numerous synonyms under this species show its variability. The supposed species differ in what may be considered individual variations, or those produced by age. It is impossible to distinguish them by either the descriptions or the figures, they are all so much alike. It has been claimed that the *O. fosteri* is the same as *O. duseri*, but no mention is made in the description of the former of the most characteristic feature of the latter, viz., the interrupted line along one side of the shell.

3. O. MOHRI, S. A. Miller. 1875.

(Cin. Quar. Jour. Sci., II, 124, fig. 10.)

Shell elongated, tapering regularly, .16 of an inch to an inch; septa rather strongly arched, distant one-fourth the diameter of the shell; *siphuncle central*, with appearance of a connected series of oval beads; greatest diameter of siphuncle about one-fourth the diameter of the shell. Outer chamber one-fourth the length of shell; *surface smooth, septa not being shown.*

Locality: Versailles, Indiana.

The species is best recognized by the smooth surface. It does not seem to have been found immediately about Cincinnati.

4. O. JUNCEUM, Hall. 1847.

(Pal. N. Y. I, 204, Pl. 47, figs. 3 *a–f*.)

Slender, terete, cylindrical, gradually tapering; septa thin; *siphuncle* small, *central;* section circular; *surface finely striated transversely.*

Locality: Cincinnati, Lebanon, Ohio.

Distinguished by the centrally situated siphuncle in connection with the transverse striæ. First described from the Trenton at Watertown, N. Y., but since found in the vicinity of Cincinnati.

5. O. TRANSVERSUM, S. A. M. 1875.

(Cin. Quar. Jour. Sci. II, 129, fig. 15.)

Shell medium size; septa arched, distant one-fourth or one-fifth the diameter of the shell; *siphuncle eccentric; outer shell thin, marked by transverse lines.*

Locality: Columbia Avenue and Eden Park, Cincinnati. 150 to 200 feet above low water.

Somewhat similar to the preceding, but with an eccentric siphuncle. The shell is also larger and the septa more distant.

6. O. ORTONI, Meek. 1872.

Meek. Pro. Phil. Acad. Nat. Sci., 1872, p. 330.
Meek. Ohio Geol. Pal., I, 155, Pl. 13, fig. 8.
Miller. Cin. Quar. Jour. Sci., II, 130.

Shell rather rapidly expanding; section oval or circular; septa close; *siphuncle lateral, but not marginal: surface* of cast *with traces of regular, obscure, longitudinal ridges;* outer shell unknown.

Locality: Cincinnati.

The traces of longitudinal ridges found in this and two of the succeeding species serve to distinguish them from the rest of the species. The rapidly expanding shell and the lateral siphuncle serve to distinguish this species. The figure given in the Ohio Survey is incorrect, as it represents the septa as being separated by elevated lines, which is not the case.

7. O. ANELLUM (ANNELLUS), Conrad. 1845.

Pro. Acad. Nat. Sci. Philadelphia, I, 334.
Hall. Pal. of N. Y. I, p. 202, Pl. 43, figs. *6a* to *f.*

"Elongated, tapering, with *very prominent,* not approximate, acute, *slightly sinuous transverse ribs,* with very fine, crowded, *profoundly wrinkled longitudinal lines;* siphuncle sub-marginal."

Locality: Versailles, Ind.

Distinguished by the prominent transverse ribs. First described from the Trenton of Wisconsin, but it has been found in this group by Mr. C. L. Faber.

8. O. ANNULATUM, Sowerby. 1818.

Mineral Conchology. Tab. 133.

Hall, Pal. of N. Y. II, p. 96, Pl. 29, fig. 3.

Hall, 18th Regents report. Printed in 20th Report Regents N. Y. p. 351, Pl. 20, figs 4, 5, 6.

Hall & Whitfield, Pal. of Ohio II, p. 147, Pl. 9, fig. 1.

White, C. A. Eleventh Rept. State Geol. Ind., (1881), p. 358, Pl. 38, fig. 1.

O. undulatum, Hisinger. (Hall.) Pal. N. Y. II, p. 293. Pl. 64, figs. 1*a* to *f*, and Pl. 65, fig. 3.

Shell cylindrical, very gradually tapering: *strongly annulated:* annulations sharply elevated, rounded on top, with deep, concave depressions between them; *septa deeply concave;* siphuncle sub-central; surface of shell with concentric lines of growth, and more or less distinct longitudinal ridges.

Locality: Versailles, Ind., Westboro, Ohio.

This species is easily recognized by the strong annulations and concave septa. The longitudinal ridges are often obscure. It has been found in the Niagara and Clinton Groups of New York, Ohio and Indiana, and is identical with English and Swedish specimens.

9. O. TURBIDUM, Hall & Whitfield. 1875.

Ohio Geol.: Pal. II, 100, Pl. 3, fig. 1.

Shell moderate size, gradually tapering; septa not close, slightly concave; siphuncle unknown; *surface marked by low, rounded, longitudinal ridges*, four or five in space of one-half inch.

Locality: Cincinnati.

The distant septa serve chiefly to characterize this species, and taken in connection with the longitudinal lines will serve to distinguish it. The figure shows the septa to be irregular, as if weatherworn.

10. O. HINDEI, James. 1878.

(Palæontologist. p. 1.)

(Pl. 4, figs. 4 *a to d.*)

Shell small, *semi-cylindrical*, gradually tapering, sometimes to a point; septa arched, oblique, three-quarters of a line to a line wide; section semi-cylindrical; *siphuncle cylindrical:* Length one-half to three inches.

Locality: Cincinnati.

This species is remarkable in being semi-cylindrical; in all the specimens the under side seems to be wanting, so that the section is a half circle instead of a whole one as in the rest of the species. Some of the

specimens are attached to the rock so that the one side can hardly be considered as worn away; others are entirely free and show a remarkable internal structure.

11. O. DUSERI, Hall & Whitfield. 1875.

Ohio Geol.: Pal. II, 97. Pl. 3, figs. 2, 3, 4.

Shell medium size, rapidly enlarging; section circular; septa concave, gradually enlarging; siphuncle eccentric, nearer centre than margin; *surface apparently smooth; edges of septa raised above the general level in form of rings*; on well preserved specimens, the surface is covered with a network of rhombic figures, visible only under the microscope; *along one side of the shell, is a narrow, raised, longitudial line,* extending the entire length, but slightly interrupted above each of the rings.

Locality: Waynesville, Ohio.

Very well marked by the raised line along the side, interrupted by the septa. The edges of the septa are also raised above the general surface. Only very well preserved specimens show the network on the surface.

12. O. CARLEYI, Hall & Whitfield. 1875.

Ohio Geol.: Pal. II, 98, Pl. 4, fig. 19.

Shell with an inner septate tube, gradually tapering; *surrounded by two other tubes*, one-eighth inch apart; septa of inner tube closely arranged; *outer tubes without septa;* siphuncle unknown.

Locality: Fayetteville, Brown county, Ohio; Covington, Kentucky; Lebanon, Ohio.

A most peculiar species. The type specimen is now in the collection of this society. The authors of the species say of it: "The specimen lies imbeded in the rock, and weathered away to near the centre of its diameter, but the section at the end shows that the inner tubes rest upon, or nearly upon, the inner surfaces of the surrounding ones." p. 99.

13. O. TENUIFILUM, Hall.

Ormoceras tenuifilum, Hall, 1847, Pal. of N. Y. I, p. 55, Pl. 15, figs. 1 *a*, *b*, *c:* 16 figs. 1 *a* to *e:* 17 figs. 1 *a*, *b*.

Elongated, sub-cylindrical, gradually tapering to an elongated conical form; *siphuncle*, ventral, annulated, or *expanded into bladder-like rings* at the junction of septa; septa moderately concave; surface marked by longitudinal, undulated, fine thread-like lines.

Locality: Cincinnati.

This species has been placed in *Ormoceras* and in *Actinoceras*. It does not seem to differ enough to exclude it from *Orthoceras*. Its chief

feature is the bladder-like expansion of the siphuncle. It was described originally from the Trenton of New York. It has been found at Nashville and occasionally here.

Genus 2. COLPOCERAS, Hall. 1850.

Third Annual Report, Reg. Univ. of N. Y. p. 181.

"Cylindrical or sub-cylindrical, septa oblique to the axis of the shell, regularly arched on the dorsal side, and bending downward in a deep sinus towards the mouth on the ventral side."

1. C. ARCUATUM, n. sp.

Arcuata from Lat. *Arcuatus*, arched, from the arched septa.

(Plate IV, figs. 1 *a* 1 *b*.)

Shell medium size, moderately tapering; *septa wide*, ¾ to ½ inch, with a slightly elevated suture between each: strongly and *regularly arched upward* on dorsal side, and as strongly and *regularly curved downward* on the ventral, so that from two aspects the septa have an oblique direction; there is no acute angle to the septa as described in *C. clarkana*, Weth., nor a deep sinus as noted in *C. virgatum*, Hall; surface irregular, often encrusted with fragments of crinoid stems or some species of coral; siphuncle apparently none, as the whole interior of the shell seems to be filled with a finely comminuted mass of fossil particles.

Locality: Cincinnati.

The type is in the collection of this society. Mr. U. P. James has specimens of the same species.

This species differs from both those heretofore described in having the septa regularly curved and arched. The type specimen, 6½ inches long, has fifteen chambers and is compressed at the larger end. Its diameter at the small end is about ¾ of an inch and at the larger 1¼ inches. A well marked ridge runs along one side, which *may* have been caused by compression. Another specimen, however, has a similar ridge, is five inches long and has twelve chambers. It is also compressed at the larger end.

Genus 3. ENDOCERAS, Hall. 1847.

Pal. of N. Y. I, pp. 58 and 207.

Siphuncle large, lateral or eccentric, marked or ridged on the outer surface by the septa, which from their oblique direction give it the appearance of a tube with spiral lines; siphuncle enclosing from one to five elongated conical tubes.

KEY TO SPECIES.

Surface marked by transverse striæ.	*E. proteiforme*, 1.
Septa concave.	*E. annulatum*, 2.
Siphuncle very large.	*E. magniventrum*, 3.
Siphuncle marginal, obliquely annulated.	*E. approximatum*, 4.
Siphuncle sub-central, with elevations at the septa.	*E. sub-centrale*, 5.

1. E. PROTEIFORME, Hall. 1847.

(Pal. N. Y., I, p. 208. Plates 45 to 50 and 53.)

General form cylindrico-conical, more or less elongated, often compressed, tapering unequally; young specimens terminating in an acute point; *surface marked by distinct transverse striæ*, usually like narrow, sub-imbricating bands, one edge well defined and more elevated than the other, more or less distinctly striated longitudinally; striæ varying from extreme tenuity to distinct, elevated thread-like lines; section circular; septa distant one-fifth to one-fourth of the diameter of shell; *siphuncle eccentric* or sub-marginal.

Locality: Cincinnati.

This species is well named, for the forms are endless. As none of them seem to be well defined, however, all running together, none of the supposed and described varieties are here considered separately.

2. E. ANNULATUM, Hall. 1847.

(Pal. N. Y., I, p. 207. Pl. 44, figs. 1 *a b*.)

Cylindrical, gradually tapering toward apex; annulations broad, rounded, equal to depressed interspaces, distant one-fifth diameter of the tube and slightly arched; *septa deeply concave*, bending more abruptly backward just before reaching the siphuncle, and more approximate than the annulations; *siphuncle* large, *sub-dorsal*, with smooth embryo tube; section circular; surface markings unknown.

Locality:

Chiefly recognized by the deeply concave septa, a character not found in any other of our species.

3. E. MAGNIVENTRUM, Hall. 1847.

(Pal. N. Y., I, p. 218. Pl. 53, figs. 1 *a* to *e*.)

Elongated, very gradually tapering; *siphuncle very large, occupying three-fifths of diameter* of the shell; septa very convex; distant one-eighth the diameter of the shell.

Locality: Cincinnati.

This species attains a very large size and is often flattened by compression. The large siphuncle and the large shell are the distinguishing features.

4. E. APPROXIMATUM, Hall. 1847.

(Pal. N. Y., I, p. 219. Pl. 54, fig. 2 *a*.)

Cylindrical, gradually tapering; septa with convexity about one-fourth the diameter and distant one-fifth the diameter of the shell; *siphuncle* large, *marginal, obliquely annulated by the thin edges of the septa.*

Locality:

The obliquely annulated, large siphuncle is the principle feature of this species.

5. E. SUB-CENTRALE, Hall. 1847.

(Pal. N. Y., I, p. 59. Pl. 17, fig. 4.)

Elongated; septa rather distant; *siphuncle* large, *sub-central, with external imbricating elevations at the attachments of the septa*; septa near siphuncle turn upwards toward apex.

Locality:

Genus 4. GOMPHOCERAS, Sowerby. 1839.

Murch. Silur. Syst. III, p. 620. *Phragmoceras.* Brod. 1839.

Shell fusiform, or bottle-shaped, sometimes compressed, straight or curved, swollen anterior; aperture contracted in the middle; last chamber large; siphuncle dorsal or sub-central; septa simple, concave. (Tryon. Struc., and Sys. Con. II, pp. 54, 55.)

1. G. EOS, Hall & Whitfield. 1875.

Pal. of Ohio, II, p. 100, Pl. 3. fig. 5.

Shell *ovoid*, tapering from below upward to middle of outer chamber and contracting above; outer chamber about one-third entire length of *shell*, the whole *of an elongate ovate form; septa* deeply *concave*, about one-fifth inch distant. Siphuncle, surface, and aperture, unknown.

Length 4½ inches, breadth of flattened specimen 3¼ inches.

Locality: Dayton and Waynesville, Ohio, and Weisburg, Indiana.

Distinguished by its size, the ovoid form and the concave septa.

2. G. FABERI, S. A. Miller. 1884.

(J. C. S. N. H. VII, 19, Pl. 4, figs. 2, 2 *a*.)

G. cincinnatiense, S. A. M. Ibid, p. 19, Pl. 4, figs. 1, 1 *a*.

Shell *small*, moderately *gibbous;* ventral side convex; dorsal convex or straight; transverse section ovoid or elliptical; siphuncle of medium

size, and close to ventral margin; *septa slightly convex* and curving forward over the contracted ventral side; chamber of habitation of medium size, rapidly contracting toward anterior end. Shell from ½ to ¾ inch long, and $\frac{6}{10}$ to $\frac{8}{10}$ inch in diameter.

Locality: Cincinnati, from middle to top of rocks.

The small size, and gibbous character of the shell, as well as the convexity of the septa will serve to separate this species from the preceding. There is too slight a difference between *G. faberi* and *G. cincinnatiense* to make two species.

Genus 5. CYRTOCERAS, Goldf. 1832.

De la Beche Handbuch der Geognosie.

Miller 1875, Cin. Quar. Jour. Sci., II, p. 131.

Shell curved or partly involute, sometimes with longitudinal, sometimes with transverse diameter the greater; aperture contracted or not; siphuncle varying from convex to concave side.

KEY TO SPECIES.

Shell curved and tapering rapidly; septa narrow. *C. vallindighami*, 1.

Septa wide. *C. faberi*, 2.

Shell ventricose. *C. ventricosum*, 3.

Shell gently curved; section elliptical; septa irregular. *C. irregulare*, 4.

Section sub-elliptical; chambers thin, septa concave. *C. magister*, 5.

Section slightly elliptical; chambers thin near the body chamber. *C. amoenum*, 6.

1. C. VALLANDIGHAMI, S. A. Miller. 1874.

Cin. Quar. Jour. Sci., I, p. 232, fig. 23.

C. conoidale, Wetherby, 1881. Jour. Cin. Soc. Nat. Hist., IV, p. 78, Pl. 2, figs. 6, 6 *a*.

Shell curved and rapidly tapering; septa short, nearly equal; section nearly circular; surface smooth; siphuncle small, dorsal. Length about one inch—17 to 20 septa—diameter at the ends .50 inch and .33 inch.

Localities: Cincinnati; Columbia, Tenn.; Garrard Co., Ky.; Westboro, Ohio.

Readily recognized by the small size, curved and rapidly tapering shell. There is not sufficient difference in *C. conoidale* to make another species.

2. C. FABERI, n. sp.

(Plate IV. Figs. 3 *a* 3 *b*.)

Shell strongly curved and gradually tapering; septa wide, ten in the space of two inches, measuring on the outer curve; section elliptical, with the the lateral diameter the greater; siphuncle small, dorsal; body chamber and surface unknown. Length on outer curve of ten septa, two inches; on inner curve, one inch.

Locality: Waynesville, Ohio; upper part of group.

This species differs from all the others heretofore described from this group in the great width of the septa in connection with the rapid curvature of the shell. From *C. vallandighami* it is separated by the gradual tapering and the wide septa.

3. C. VENTRICOSUM, S. A. Miller. 1875.

(Cin. Quar. Jour. Sci., II, p. 131, fig. 16.)

Shell ventricose, gently curved and rapidly enlarging toward the aperture; section circular, or nearly so; septa slightly concave, curving forward on dorsal side; *siphuncle* nearly marginal on dorsal side, *abruptly expanded within the chambers.* Diameter of the ends in a specimen 2.30 inches long, .44 and 1.20 inches.

Locality: Columbia Avenue, Cincinnati, 150 feet above low water.

The ventricose shell, larger size and abruptly expanding siphuncle in the chambers, will distinguish this species from the preceding ones.

4. C. IRREGULARE, Wetherby. 1881.

(Jour. Cin. Soc. Nat. Hist., IV, p. 79. Pl. 2, fig. 3.)

Shell moderately curved; septa nearly equal in anterior third, shorter and smaller in posterior third of length; *section elliptical;* siphuncle comparatively large, and dorsal.

Localities: Freeport and Waynesville, Warren Co., Ohio, and Versailles, Indiana; upper part of group.

The irregularity in size of the septa, and the elliptical section are the main features which distinguish this species from the others.

5. C. MAGISTER, S. A. Miller. 1875.

(Cin. Quar. Jour. Sci., II, p. 284.)

C. obscurum, S. A. M. Ibid, II, p. 132, fig. 17.

Shell moderately curved, enlarging toward aperture; section subelliptical, with transverse diameter the greater; septa slightly concave; *chambers thin;* siphuncle dorsal. Length of fifteen septa, 3.40 inches, on

dorsal, 2.18 inches on ventral side. Transverse diameter at the ends 2.90 inches and 2.54 inches.

Locality: 1st ward, Cincinnati, 130 feet above low water.

5. C. AMŒNUM, S. A. Miller. 1878.

(J. C. S. N. H., I, 105. Pl. 3, fig. 8.

Shell two to three inches long, gently arched and gradually tapering; *section slightly elliptical; body chamber* slightly contracted toward front, *followed by five or six thin chambers;* septa moderately arched; siphuncle small, close to dorsal margin.

Localities: Richmond, Indiana; Cincinnati.

The two preceeding species are too closely allied, and it seems likely they may be the same. The differences are so slight that they are easily accounted for by the difference in locality, the first having been found here and the second coming from Richmond.

Genus 6. LITUITES, Breynius. 1732.

(Tryon, 1883, Struct. and Syst. Concho., II, p. 56.)

Trocholites, Conrad, 1838. Sec. Ann. Rep. Geol. Sur. N. Y., p. 118. *Emended* Jour. Phil. Acad. Nat. Sci., VIII, p. 274.

"Shell planorbiform, the whorls close or separate; the last chamber produced in a straight, or outwardly curved line; lateral margins of the aperture extended and curved toward the interior of the shell, contracting the aperture into two distinct orifices." (Tryon.) "Siphuncle central or sub-central." (Woodward, Man. Mol., 1880, p. 189.)

1. L. PLANORBIFORMIS, Conrad.

Trocholites planorbiformis, Conrad. 1842. Jour. Phil. Acad. Nat. Sci., VIII, p. 274. Pl. 17, fig. 2.

Trocholites planorbiformis, Con. Hall. Pal. of N. Y., I, 310. Pl. 84, figs. 3 *a to f.*

"*Volutions higher than wide, longitudinally striated*, and with *oblique, obtuse, transverse lines*, approaching at an angle, but rounded on the centre of the back; apex profoundly depressed; back of large volution flattened; aperture much longer than wide."

Locality.—(Type) "Grimsby, upper Canada."

A specimen of what appears to be this species, is represented in the cabinet of this Society by a plaster cast. The label attached bears the name of "*Trocholites cincinnatiensis*, Clark." No such species has ever been described. It is, from the name, from this locality.

2. L. circularis, Miller and Dyer.

Trocholites circularis, M. and D., 1878. Contri. to Pal. No. 2, p. 9, Pl. 3, fig. 10.

T. minusculus, M. and D. Ibid, Pl. 3, fig. 11.

Shell planorbiform; volutions three to five, gradually enlarging to aperture, and deeply embracing; *section sub-circular or sub-elliptical;* septa straight or directed backward, arched; apex profoundly and equally depressed on each side, perhaps perforated; body chamber long, constituting more than half the last volution; *aperture deeply notched on outer side;* surface markings unknown.

Localities: Morrow, Ohio, and Cincinnati.

The differences between these two species (*L. circularis and L. minusculus*,) are insufficient for two species, and no more than individual variations or those produced by difference in locality. One was described from Cincinnati and one from Morrow, Ohio.

3. L. baeri, Meek and Worthen.

Trochoceras (?) *baeri*, M. and W., 1865. Pro. Phil. Acad. Nat. Sci. for 1865, p. 263.

Trochoceras (?) *baeri*, Meek, 1873. Pal. of Ohio, I, p. 157, Pl. 13, fig. 9.

Trochoceras baeri. Miller, Cin. Qua. Jour. Sci., II, p. 134.

Shell sub-discoidal, with two or three rather rapidly enlarging whorls, more broadly rounded on the outer surface than the side, and one-fourth wider than high; each inner whorl impressing inner side of succeeding; umbilicus a little more than one-half dorso-ventral diameter of outer volution and showing all inner volutions; *spire apparently scarcely rising above upper surface* of last turn; *septa* concave on side facing aperture; separated on outer side of whorls by spaces, all *showing* very *slight backward curve* on periphery and passing nearly straight across each side; surface, siphuncle and non-septate, unknown.

Locality: Richmond, Indiana; upper part of the group.

Meek and Worthen in the original description refer this species to *Trochoceras* with a mark of doubt, and say that it may belong to *Lituites*. Meek in Ohio Palæontology—vol. I, p. 157—again says: "The specimen from which this description was drawn up was defective on one side, so that it is not easy to determine whether or not its whorls are coiled in exactly the same plane, though they have the appearance of being somewhat oblique, and hence it was placed provisionally in the genus *Trochoceras*. Should it be found, however, when better specimens came to be

examined, that its whorls are coiled and in the same place [plane ?] it would belong either to the genus *Lituites*, or to some other section of the genus *Nautilus*, as the latter group is understood in its less restricted sense, and of course have to take the name *Lituites Baeri* or *Nautilus Baeri.*" The former of these two names is the one here given it.

4. L. AMMONIUS, Conrad.

Trocholites ammonius, Con. 1838. Sec. Ann. Rept. Geol. Sur. of N. Y., p. 119. Hall. Pal. N. Y., I, pp. 192 and 309. Pl. 40 A, figs. 4 *a to k.*, and Pl. 84, fig 2 *a b c.*

Shell discoidal; volutions rounded, slightly concave on ventral side, gradually enlarging towards aperture; *septa direct*, or *undulated* on dorsal side; *surface* with *more or less distinct irregular transverse striæ* or ridges; outer chamber large; siphuncle central.

Locality: Cincinnati.

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1732. Breynius, J. P. H. De melonibus petrefactis montis Carmel vulgo creditis et de polythalamiis nova testaceorum classe.

Containing descriptions of the genera, *Nautilus*, *Lituites*, and *Orthoceras.*

1818. Sowerby, J. Mineral Conchology.

Description of *Orthoceras annulatum.* Tab. 133.

1832. Goldfuss. De la Beche, Handbuck der Geognosie, nach der 2, Auflage des Engl. Originals bearbeitet von H. v. Dechen (die Petrefakten-Verzeihnisse darin von Goldfuss).

Description of *Cyrtoceras.*

1838. Conrad, T. A. Second Annual Report of the Geological Survey of New York.

Description of genus *Trocholites* and species *T. ammonius*, page 119.

1838. Stokes, Charles. Transactions of Geological Society of London. Second series, Vol. V.

Description of *Ormoceras.*

1839. Brodie, P. B. In Murchison's Silurian System, Vol II, page 621.

Description of *Phragmoceras.*

1839. Sowerby, J. Murchison's Silurian System, Vol. III.

Description of *Gomphoceras.* Page 620.

1842. Conrad, T. A. Journal of the Philadelphia Academy of Natural Sciences, Vol. VIII.

Description of *Trocholites planorbiformis*, (page 274), (see under *Lituites*,) and re-description ot genus *Trocholites*.

1843. Conrad, T. A. Proceedings of Philadelphia Academy of Natural Sciences, Vol. I.

Description of *Orthoceras annellus*, (page 334).

1847. Hall, James. Palæontology of New York, Vol. I.

Contains descriptions of genus *Endoceras* (pp. 58 and 207), and species: *E. proteiforme* (page 208), *annulatum* (page 207), *magniventrum* (page 218), *sub-centrale* (page 59), and *approximatum* (page 219). Also, *Orthoceras amplicameratum* (page 205), *O. junceum* (page 204), *O. anellum* (page 202), and *O. tenuifilium* (page 55), as *Ormoceras tenuifilium*; also, *Lituites* (*Trocholites*) *ammonious* (pp. 192 and 309).

1850. Hall, James. Third Annual Report of the Regents of the University of New York. 1850.

Contains generic description of *Colpoceras*, page 181.

1852. Hall, James. Palæontology of New York, Vol. II.

Description of *Orthoceras annulatum* (p. 96), and as *O. undulatum* (p. 293).

1865. Meek, F. B. and Worthen, A. H. Proceedings of Philadelphia Academy of Natural Sciences for 1865.

Description of *Trochoceras* (?) *baeri*, (page 263), (see under *Lituites*.)

1867. Hall, James. 20th Report of the Regents of the University of the State of New York on the condition of the State Cabinet of Natural History.

Description and figures of *Orthoceras annulatum*.

1872. Meek, F. B. Proceedings of Philadelphia Academy of Natural Science.

Description of *Orthoceras ortoni*, (page 330.)

1873. Meek, F. B. Geological Survey of Ohio. Palæontology, Vol. I.

Descriptions and figures of *Orthoceras Ortoni* (page 155), and *Trochoceras* (?) *baeri* (page 157), (see under *Lituites*).

1874. Miller, S. A. Cincinnati Quarterly Journal of Science. Vol. I.

Description of *Cyrtoceras vallandighami*, (page 232).

1875. Hall, James, and Whitfield, R. P. Geological Survey of Ohio. Palæontology, Vol. II.

Description and figure of *Orthoceras turbidum* (page 100), *O. duseri* (page 97), *O. annulatum* (page 147), and *O. carleyi* (page 98). *Gomphoceras eos* (page 100.)

1875. Miller, S. A. Class *Cephalopoda* (Cuvier) as represented in the Cincinnati Group. Cincinnati Quarterly Journal of Science, volume II, pages 121 to 134, and page 284.

A review of the class and descriptions of nine new and one old species of *Orthoceras*, two new species of *Cyrtoceras*, two species of *Endoceras* and one *Trochoceras*. This partly covers the ground of the present paper and seems to be the first attempt toward the collection of the descriptions of the genera and species of the class. There are figures in outline of most of the new species.

1878. Miller, S. A. Journal of the Cincinnati Society of Natural History. Vol. I.

Description of *Cyrtoceras amœnum*, (page 105).

1878. James, U. P. Palæontologist. No. 1.

Description of *Orthoceras hindei*, (page 1).

1878. Miller, S. A., and Dyer, C. B. Contributions to Palæontology. No. 2.

Descriptions of *Trocholites circularis* and *T. minusculus* (pages 10 and 11), (see under *Lituites*.)

1879. Hall, James. Cephalopoda of Up. Helderberg, Hamilton, Portage and Chemung groups. Palæontology of New York, vol. V, part 1, pages 217 to 480.

This account opens with an historical sketch of the genus *Orthoceras*, in the course of which mention is made of the American species of the genus described since 1823, comprising a full bibliography of the subject. This is followed by some remarks on the genus and its allies, and by descriptions of twenty-one old species, forty-six new ones and one new variety. The genera *Bactrites*, *Gomphoceras*, *Cyrtoceras*, *Gyroceras*, *Trochoceras*, *Nautilis* and *Goniatites* are taken up and treated in the same way. The volume of plates makes part 2 of vol. V.

1880. Woodward, S. P. A Manual of the Mollusca; London, 1880.

Definitions of genera of fossil Cephalopods are given on pages 168 to 201, with a description of the living *Nautilus*. In the appendix Ralph Tate gives fuller descriptions of some genera, and a few new ones are added in the first 12 pages. Most of the genera are represented by a figure of one species at least.

1880. Miller, S. A. Journal of the Cincinnati Society of Natural History, vol. III.

Re-descriptiom and figure of *Orthoceras Dyeri*. (page 236.)

1881. Wetherby, A. G. Journal of the Cincinnati Society of Natural History, vol. IV.

Description of *Cyrtoceras conoidale* (page 78), (see under *C. vallandighami*), and *C. irregulare* (page 79).

1881. White, C. A. In Eleventh Report of State Geologist of Indiana.

Description and figure of *Orthoceras annulatum* (page 358).

1881. Whitfield, R. P. Observations on the purposes of the embryonic sheaths of Endoceras, and their bearing on the origin of the siphon in the Orthocerata. In Bulletin No. 1 of American Museum of Natural History (Central Park, New York), page 20.

In this the writer examines the theory of the embryonic nature of the sheaths of *Endoceras*, and concludes against it. He fully describes the features presented by the duplicate siphons. Various specimens show that while the animal occupies the outer chamber, part of the body extends into the siphonal cavity in the shape of a long, loosely-hanging finger. "These sheaths were not only formed in case of accidents already having taken place, but were probably often formed to guard against future troubles." (p. 23).

1881. Miller, S. A. Journal of the Cincinnati Society of Natural History. Vol. IV.

Notice and figures of *Orthoceras byrnesi*, *O. fosteri*, *O. cincinnatiense*, *O. harperi* (see 319), (see under *O. dyeri*).

1883. Tryon, Geo. W. Structural and Systematic Conchology. Phila.

In volume II on pages 13, 26, 27, 33, 45 to 48, and 50 to 87 are descriptions of the genera and sub-genera of fossil cephalopods. There are figures of many of the genera. The descriptions are short and in some cases in almost the same words as in Woodward's Manual.

1884. Miller, S. A. Journal of the Cincinnati Society of Natural History. Vol. VII.

Descriptions of *Gomphoceras faberi* and *G. cincinnatiense* (page 19).

1884. Hyatt, A. Genera of Fossil Cephalopods. In Proceedings of Boston Society Natural History. Vol. XXII. 1883. (Published Jan., 1884.) Page 253 and *et seq.*

This paper, occupying eighty-five closely printed octavo pages, is, we are told, "preliminary to a monograph which will appear in the Memoirs of the Museum of Comparative Zoology." In it the author has attempted to arrange the genera of fossil cephalopods according to a graded series, from the first straight chambered shells (*Orthoceras*) through the arcuate (*Cyrtoceras*), the loose coiled (*Gyroceras*), to the close coiled (*Nautilus*). "The generic terms Cyrtoceras, Gyroceras, Nautilus, are," he says "really only descriptive terms for the different stages in the development of an individual, and also the different stages in the development or evolution of the series of adult forms in time. In other words, each of these genera are now used to indicate representatives of all the different generic series of Tetrabranchs, which are either young shells in the corresponding stage of growth, or adult shells in the corresponding stage of evolution." (Page 254.)

By an examination of the embryos, the siphons, the sutures, and other features, the author formulates a series of orders and genera which are simply appalling. There are enumerated in this paper no less than eighty-three new genera, most of them formed on species of older genera which differ in a few characteristics from their fellows. For example, in regard to *Orthoceras*, which Professor Hall says* includes 323 species in North America, Prof. Hyatt says he "has met with but two species in North America, though doubtless others may exist, since the extreme smoothness of the shell is easily destroyed." He thinks the generic term should be restricted to "straight and comparatively smooth longicones with simple septa and sutures."† He then makes five new genera based on species of *Orthoceras* in addition to two previously made. *Gomphoceras*, *Cyrtoceras* and *Phragmoceras* each furnish several new generic names. Many of these seen to be founded on very insufficient characters, although what should be considered a good character is a matter of opinion merely. For example, *Tetramoceras* "includes Silurian species having four lateral sinuses," which were previously referred to *Phragmoceras*. *Hexameroceras*, "includes Silurian species having six lateral sinuses in their apertures," also previously placed in *Phragmoceras*. *Trimeroceras*, *Pentameroceras* have respectively, two, four and six lateral sinuses in addition to a median sinus, all these having been previously referred to *Gomphoceras*, while this last genus is restricted to the "straight and arcuate forms which have symmetrical T-shaped apertures."‡

It is an unfortunate tendency which many writers have developed to establish new names on slight differences. It is reprehensible to make new species on insufficient grounds, and still more unpardonable to establish genera. It is especially deplorable and common in palæontology, not only because of the fragmentary nature of the fossils, but because of our limited knowledge of the modes of life, the geographical distribution, and other facts which are invariably taken into consideration when living organisms are concerned.

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* Pal. of N. Y., vol. V, part 2, (text) p. 230.

† Page 275.

‡ Pages 277–78.

Dr. W. A. Dun mentioned the occurence of a fire-ball which fell between two horses, and, without injuring either, broke a stone lying on the ground.

The following were proposed for regular membership:

Dr. C. L. Boutillier, G. N. Merryweather,
Dr. W. S. Christopher, Dr. Chas. E. Caldwell,
Wm. Lytle Foster.

The gentlemen proposed for membership at the October meeting (see *ante* page 230) were duly elected.

Dr. O. D. Norton exhibited specimens of Jasper and Chrysocolla from Arizona.

Dr. Wm. Carson was elected Curator of Photography, and Mr. E. S. Comings, Curator of Meteorology.

Donations were announced as follows: From Chief Signal Officer, "Monthly Weather Review" for August, 1885; from Kentucky Geological Survêy, "Geology of Clark and Montgomery, Marion, and Spencer and Nelson Counties;" from Smithsonian Institution, "Proceedings of United States National Museum," Vol. VIII, Nos. 32 to 34; from United States Fish Commissioner, "Bulletin of U. S. F. C.," Vol. V, Nos. 22 to 27, Plates 1 and 2; from Director of United States Geological Survey, "Annual Report for 1882–83;" from Prof. Edgar F. Smith, Specimen of Corundrum; from Fred. Braun, 42 specimens of minerals, rocks and fossils.

Meeting of *December* 1, 1885.

President Harper in the chair, and fifteen members present.

Mr. J. Ralston Skinner read a paper on "Measures of the Mound Builders." He referred to the ancient use of the Inch Measure and its connection with modern life. The ratio of 113 : 355 as the diameter to circumference of a circle, and the ratio of 6561 : 20612 were spoken of. He said that from the accuracy with which the British inch and foot fitted into the dimensions of the Great Pyramid of Egypt, that he had no doubt the builders of that work had a full knowledge of these measures. He also considered that the same monument contained measures of time and space, because of the very peculiar manner in which they were correlated. Turning to the Mound Builders of the Ohio and Mississippi valleys, he described the dimensions of the Gest Tablet and the Gridley Measuring Stone, both of which had been taken from the elliptical mound formerly standing on what is now Sixth and Mound Streets. He regarded the

latter, a semi-elliptical stone, exactly nine inches long on the straight edge, and exactly twelve inches on the curve, as the measuring stone of the ancient Mound Builders. He referred to the detailed measures of the mounds made by Squier and Davis, and showed how the works could be separated into three groups, in which the circle 1050 feet in diameter, and a square 1080 feet to the side, were connected in a peculiar manner. He quoted the opinion of Squier and Davis that the Mound Builders possessed some standard of measure, and gave as his opinion that the semi-elliptical stone was the measure in question. The paper will be published in a future number of this JOURNAL.

The following papers were read and referred to the Publishing Committee:

DESCRIPTION OF A NEW SPECIES OF GOMPHOCERAS, FROM THE TRENTON OF WISCONSIN.

BY PROF. JOSEPH F. JAMES,
Custodian Cincinnati Society of Natural History.

GOMPHOCERAS POWERSI, n. sp. Plate IV, fig. 2.

Shell medium size, oblong-oval; ventral side nearly straight, dorsal curved; body chamber contracting slightly near the aperture, and then expanding into a sort of lip, and occupying at least one-half the length of the shell: septa narrow, four or five in number: below the septa the shell contracts and tapers to where broken with no indication of septa: aperture broad oval on the ventral and contracting rapidly and rounding in on the dorsal side: siphuncle unknown. Length on straight side two inches; on curved two and one-half inches.

Locality and Formation: Beloit, Wisconsin. Trenton. Collection of C. L. Faber, Jr. The species is named in honor of Mr. H. C. Powers, of Beloit, Wisconsin.

THE MYCOLOGIC FLORA OF THE MIAMI VALLEY.

POLYPOREI. (Concluded.)

BY A. P. MORGAN.

[This paper will be printed in the next number of the JOURNAL.]

NOTES ON THE DISTRIBUTION OF TERTIARY FOSSILS IN ALABAMA AND MISSISSIPPI.

By T. H. Aldrich.

Such was the abundance of life in the Southern old Tertiary that one can hardly spend a day collecting in that region without finding new forms, and new localites for old ones, hitherto unsuspected. The different groups of the Tertiary series have many species in common, and their position must be determined from the general fauna found in each, and the actual superposition rather than from any especial forms, although they no doubt occur. Until the fauna of each division is much more thoroughly investigated than at present, it will be almost impossible to say what species are guides or "finger-posts" to the groups in question. Prof. E. W. Hilgard* states that nowhere has he been able to find *Orbitoides* associated with the bones of the Zeuglodon, or any of the characteristic fossils of his Jackson Group, and this statement is repeated by Heilprin (United States Tertiary Geology, p. 34); but in some material lately collected for me at Jackson, on Dry or Town Creek, from the beds, four and five of Prof. Hilgard's section (No. 27)† I find portions of *Orbitoides supera Con.* and *Orbitoides Mantelli Con.* associated with a few *Nummulites.* These beds immediately underlie the strata in which occur the Zeuglodon bones.

The specimens are found with the well-known "Jackson" fossils in their very "matrix," and at the typical locality for the Jackson Group. Dr. Otto Meyer‡ mentions finding an *Orbitoid* in the Claiborne Group (his bed "*b*").

We thus have evidence of the occurence of *Orbitoides* in the Claiborne, Jackson and Vicksburg Groups, giving a far larger range than was supposed, and destroying the value of *Orbitoides* as an exclusively *Oligocene* "Leit fossil" in the Tertiary of the South.

One specimen of the *Nummulite* found with the above *Orbitoid* has a strong resemblance to *N. wilcoxi*, of Heilprin, recently described from Florida.

Foraminifera are very abundant at the Vicksburg outcrop near Byram Station, Miss., associated with *Orbitoides.* A form in a siliceous limestone, from just beneath the calcareous sand bed of the Claiborne Group,

*On the Tertiary Formations of Mississippi and Alabama, A. J. C., V. 43, p. 30. 1867.

†Ag. and Geol. of Miss., p. 131. 1860.

‡Geneal. and Age of the Species in the Southern Old Tertiary, A. J. S., Vol. 30, 1885.

has lately been received from Dr. E. A. Smith, State Geologist of Alabama. The exact location is 7½ miles east of Monroeville, Alabama.

Among the material collected at Vicksburg, Miss., is a Nautilus—sp.? which, I believe, is the first instance of this Cephalopod occuring in the *Oligocene* of this country.

Mr. Aldrich exhibited specimens of *Orbitoides* and other genera, and also a new species of crab from the Tertiary of Alabama.

The following names were proposed for regular membership:

Miss Anna M. Brown.
John H. Warder.
Dr. Frank Hunter.
Joseph Nichols.
Warner Galway.
T. B. Collier.
Dr. B. Merrill Ricketts.
Rev. H. D. Waller.
S. S. Bassler.
Dr. W. K. Boylan.
G. W. Eger.

The following were elected to regular membership:

Wm. Lytle Foster.
Dr. W. S. Christopher.
Dr. Chas. E. Caldwell.
G. N. Merryweather.
Dr. C. L. Boutillier.

Mr. E. S. Comings resigned the Curatorship of Meteorology, and Dr. W. A. Dun was elected to fill the vacancy.

Prof. Jos. F. James moved a committee be appointed to revise the Constitution and By Laws of the Society. The following was the committee as named by the Society:

Prof. Geo. W. Harper.
Mr. J. R. Skinner.
Prof. Jos. F. James.
Mr. Wm. Hubbell Fisher.
Dr. Walter A. Dun.

The Society decided to give a microscopical Exhibition in the the building on Tuesday evening, December 15th, to the members and invited guests.

Donations were announced as follows: From Smithsonian Institution, "Proceedings of United States National Museum," Vol. VIII, Nos. 35, 36, 37, 38, plates 20, 24, 25; from United States Fish Commission, "Bulletin U. S. F. C.," Vol. V, Nos. 28, 29, 30, Title and Index; from Bureau of Education, "Historical Sketch of Colleges and Universities of the United States;" from Chief Signal Officer, "Monthly Weather Review," Sept., 1885; from Dr. R. W. Shufeldt, "Description of *Hesperomys Truei;*" from Dr. Schaffranck, "Flora of Palatka, Fla.;" from Director of the United States Geological Survey, "Bulletins," Nos. 7—14; from Lieut. P. Henry Ray, "Report of the International Polar Expedition to Point Barrow, Alaska."

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Agriculture, Commissioner of. Washington.
Agricultural Grasses of the United States, by Dr. Geo. Vasey.
American Entomological Society. Philadelphia. List of the Coleoptera of America north of Mexico, by Samuel Henshaw.
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Beecher, C. E. Albany, N. Y. Some Abnormal and Pathologic forms of Fresh Water Shells from Albany.
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INDEX.

THE END.

Description of Plate IV.

PAGE.

Fig. 1. Colpoceras arcuatum, n. sp.......................................242

a. Dorsal view of type specimen, showing upward curvature of septa.

b. Ventral view of same, showing downward curvature of septa.

Collection of Cin. Soc. Nat. Hist.

Fig. 2. Gomphoceras powersi, n. sp. Collection of C. L. Faber, Jr..........255

Fig. 3. Cyrtoceras faberi. n. sp.......................................246

a. Showing upper surface of type specimen.

b. Same, cut longitudinally, showing curvature of septa.

Collection of C. L. Faber, Jr.

Fig. 4. Orthoceras hindei, U. P. James.......................................241

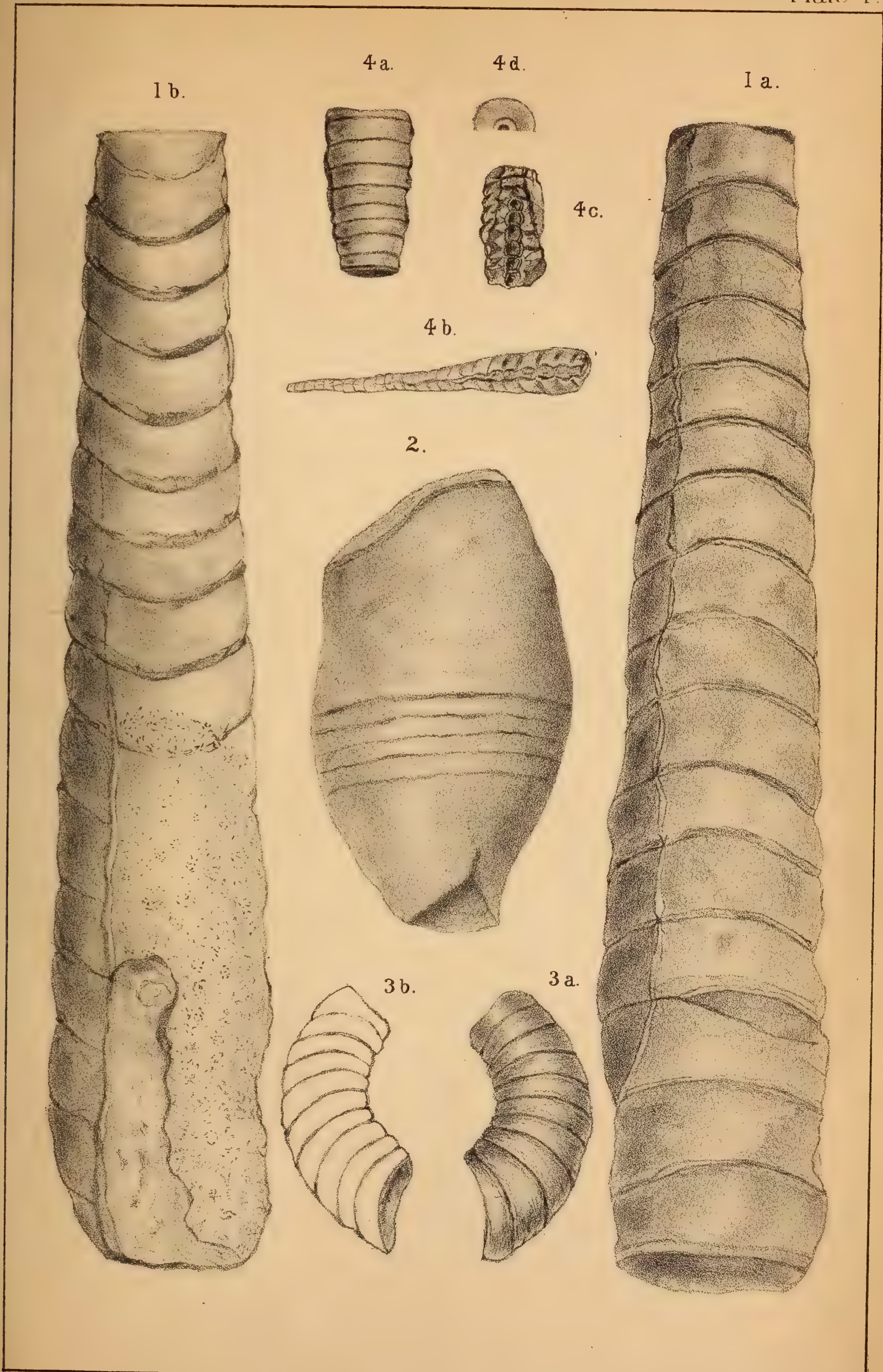
a. Showing upper surface of typical example.

b. Under surface, showing form of siphuncle.

c. Another example, showing structure of siphuncle.

d. End view, showing cross section, the lower half being invariably absent.

Collection of U. P. James.



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